SCIENTIFIC AMERICAN

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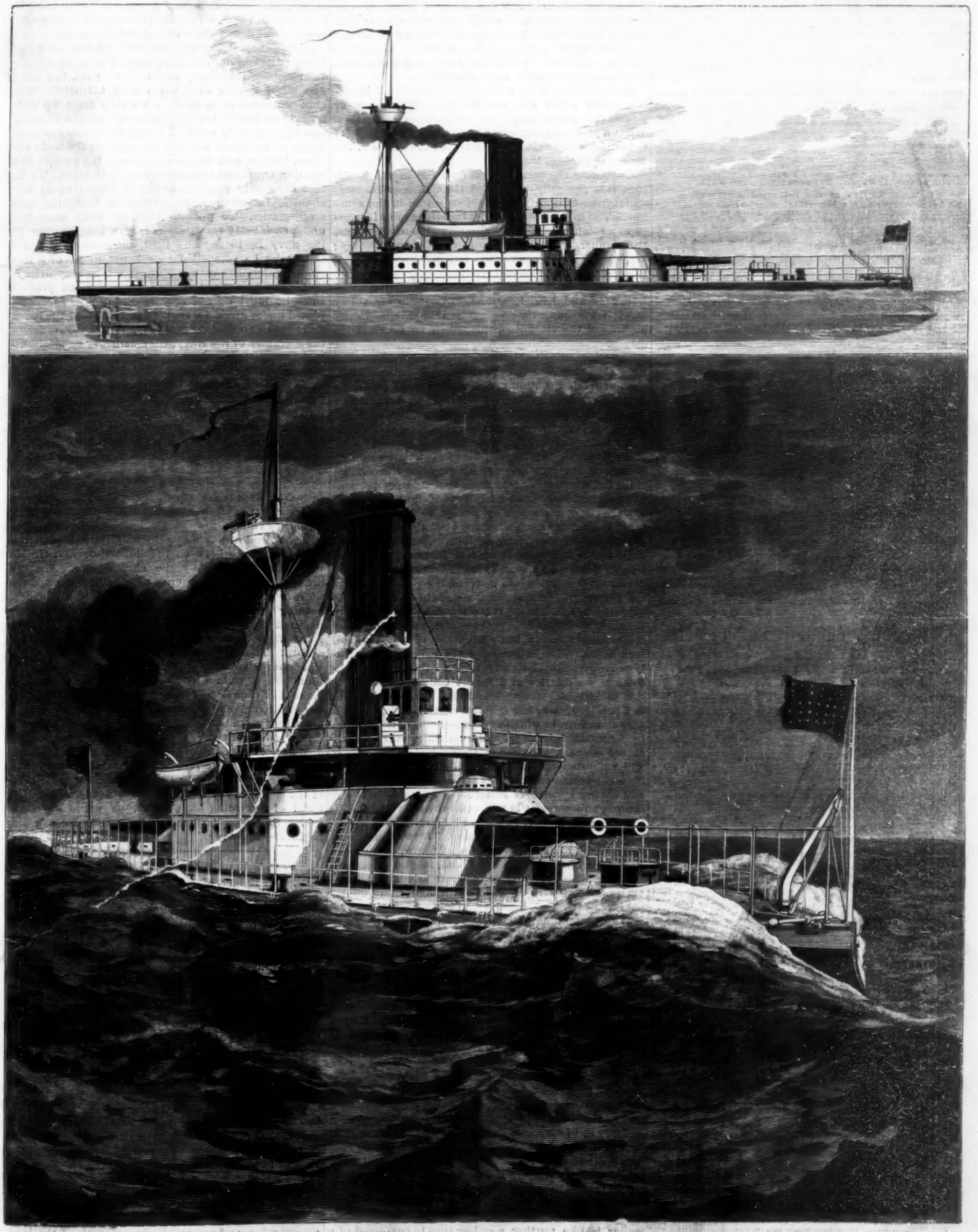

THE NEW COAST DEFENSE VESSEL MONTEREY, BUILT AT SAN FRANCISCO.—[See page 389.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 19, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 833.

For the Week Ending December 19, 1891.

Price 10 cents. For sale by all newsdealers.

THE WORLD'S COLUMBIAN EXPOSITION.

The progress of the various divisions charged with the preparation of the World's Columbian Exposition of 1893, is not only satisfactory, but marvelous. The great buildings are beginning to rise from the ground as if by magic, the surrounding lands are rapidly being converted into gardens of beauty, railroads and avenues of access are being established, the hum of mighty workings is heard in every direction, and evidence of active growth toward early completion is everywhere presented.

In extent, variety, and novelty, this exposition will far overshadow anything of the kind the world has ever seen, or is likely to see, for years to come. The French exposition of 1889 was a grand affair, greatly superior and much more costly than any similar preceding enterprise. The area covered by buildings was seventy-five acres, and the cost nine and a half millions of dollars. The architecture and general appointments were of the finest description.

The buildings of the Columbian Exposition it is estimated will cover one hundred and fifty acres, or double the roofed space of the Parisian exhibition. What a glorious spectacle, what a vast panorama of industrial wonders, will be presented to the eye of the visitor at Chicago!

Respecting the architectural qualities of the buildings, it is generally conceeded the Chicago structures will surpass in beauty all previous works in the same line. The designs for the chief buildings were intrusted to a committee of the leading American architects, the members located in different parts of the country; and the adopted plans are the independent results of the best talent and careful study.

The Liberal Arts and Manufactures Building is 788 feet wide and 1,700 feet long, covering over thirty acres; astonishing for its gigantic dimensions, to say nothing of the elegance displayed in its constructive details.

The other principal buildings, such as the Palace of Fine Arts, the Woman's Pavilion, Agricultural Hall, Administration Building, Machinery Hall, Palace of Electricity, Horticultural Building, Transportation Building, Mining Building, Government Building, are notable for their great area and architectural beauty.

The estimated aggregate cost of this extraordinary exposition is twenty-three millions of dollars—a much larger sum than the original figures; but the original plans did not contemplate such vast and comprehensive proportions as were at last decided upon. Great as were the first plans, they proved to be inadequate for the enormous demands made upon the directors for space for most important exhibits. The enlargement could not be foreseen. It became necessary by a process, as it were, of natural growth, due to the stupendous nature of the whole undertaking.

Congress will be petitioned for additional aid to the extent of five millions. It is a reasonable and worthy petition, which we hope will be promptly granted, by unanimous voice, in both branches of the national legislature. The promotion of the exposition is a national duty. In the early days of this great enterprise the rivalaries of different claimant cities gave rise to idle bickerings; but these have disappeared, and it is now plain enough the exposition is purely a national affair, in which every good citizen is bound to be personally interested, and from which every section of the country will derive incalculable benefits. It will enlighten the minds of millions of our people, hitherto restrained and dwarfed by local prejudices and narrow spheres of action, to the vastness of our country's resources. It will open their view to the astonishing enterprise, power, and activity which prevail in the more thrifty places. It will give new impetus to industries, in multiplied forms, throughout the length and breadth of the land, inspire backward localities with the spirit of progress, and animate the entire country with desires for still higher and nobler achievements.

We devote billions of money to purposes of education, to the promotion of commerce, the improvement of highways, railways, rivers, harbors; we impose taxes, grant subsidies, create bureaus, and foster all kinds of schemes that give promise of public good.

The promotion of the Columbian Exposition is a measure calculated to uplift the nation and confer enduring benefits upon the inhabitants of all the States. The treasure so devoted will come back to the people with interest a thousandfold.

THE ENGINEER AND THE SAILOR.

If the blue jacket is to be superseded to a very large extent, as now seems likely, by the machinist, then the navigating officer must needs learn to handle machinery or be displaced by an engineer who has learned navigation and gunnery. For the modern war ship has come to be a machine, or, rather, a collection of machines; her masts, if she have any, of the "military" type, with no yards across and barren of sails, topped only with nests for observation and light batteries. To place such a craft under the command of a sailor is like putting a sailing ship in command of a machinist.

If, however, it should still be found advisable to continue the system of a general executive without special engineering training to command the ship, a radical change will undoubtedly be required in the present practice of rating of line and staff, at least where engineer officers are concerned; nor is it likely that the present rule debarring them from command outside the engine room, that is to say, "on deck," will be found much longer practicable. It is now clearly seen that low rating, low pay, and small consideration are driving the really desirable engineers ashore, where the demand for engineering skill is active, and the compensation commensurate with ability. Chief Engineer of the Navy Melville dwells upon this in his recent report, protesting that there is not a sufficient force of engineers in the service at the present time to properly care for and direct the working of the engines.

Marine engineering means much more now than formerly; the engines are more complicated in design, the pumping machinery and that to work the guns and steering gear demands expert attention. The chief engineer of a modern warship must be able quickly to detect the symptoms of uneven running and apply a ready relief; he must be able to make all kinds of ordinary repairs, not only in the main engines, but as well in the condensers, the pumps, the steering apparatus and gun-operating devices. To do this effectively requires a liberal education in mechanics, including a knowledge of designing and mathematics. To put an engineer thus equipped under such petty restraints as is now the practice in the navy is, to say the least, unreasonable. Why should he be compelled to ask permission of a line officer, unfamiliar with engineering, if he may draw a bolt, drive a rivet or the like? Yet under the present rules he must do so; a chief engineer was recently placed under arrest for such an infraction of the rules, and though an apology was made to him by order of the Secretary of the Navy, the emergency being shown to have existed and the machining requisite and necessary, the rule still stands, and he can be arrested again when he repeats the so-called offense against "good order and navy discipline."

In the merchant marine service, notably on the big modern passenger steamers in the transatlantic trade, the importance of the master or "captain," as he is called by the passengers and crew, and the inconsequence by contrast of the chief engineer, seems quite as absurd. The captain is said to "work" the ship, but really the work consiste principally of calculating the running of the ship from noon to noon, a simple task, since they run most of the way on the same parallel of latitude and the change in longitude is denoted by the difference between the ship's time and Greenwich time as given by the chronometer. On the broad seas, where an error of five miles or more short or long of the course is of little consequence, nothing like so much skill in navigation is required as in the coasting trade, for when the seagoing steamer approaches the land, a pilot is taken aboard. The engineer, on the other hand, has the whole burden of the ship's progress placed upon his shoulders; it rests with him whether the ship shall make slow time or fast time, and when any part of the complicated machinery breaks down, it is to his skill alone that all must look for succor.

And so in heavy weather, when passengers inquire anxiously of the captain as to the chances, he has little or nothing to base an estimate upon, though he may look ever so wise, for he cannot know the conditions of the engine's working or the stress thereof, and instead of hazarding an opinion, he would do much better to reply, "I'll just step below and ask the engineer—he knows."

Anti-acid Boiler Lining.

Dr. Carl Kelner, of sulphite pulp fame, describes a process which aims to facilitate the lining of boilers or digesters with an acid-resisting medium. It relates principally to the use for this purpose of blocks, slabs, or tiles in combination with a preparatory cement of composition. The first coating consists of a cement formed from ground slate mixed into a paste with silicate of soda or water glass. Upon this cement as a foundation is applied (while it is in an adhesive state) blocks or slabs formed by preference of the following mixture: About one part of ground slate, two parts of ground glass, and one part of Portland cement mixed into a paste with a solution of water glass. The blocks or slabs, after being moulded, are allowed to become dry, and are then placed in position upon the coating of preparatory cement and the interstices filled in with the same mixture of which the blocks or slabs are composed. Instead of using blocks or slabs composed as above, a combination may be used with the preparatory cement of blocks or tiles made from toughened glass or from burnt clay or other compositions or materials which possess the requisite acid-resisting qualities.

THE Dominion of Canada has an area of 3,382,000 square miles, and comprises one-sixteenth of the land surface of the globe.

Surfacing Gelatine Prints.

I know of nothing more aggravating than after carefully finishing a fine positive to your satisfaction, having it stick fast to a glass plate, defying all attempts to remove it, and having finally to scrape it away in shreds to get the glass clean. But a few failures lead to success. I soon found the right way, and curiously enough, when thoroughly accustomed to the work, you become absolutely certain and confident of the result; not the slightest hesitation nor fear of sticking enters the mind.

Almost any kind of glass will do, provided its surface is good and free from bubbles, scratches, or other defects. Although plate glass is usually recommended, it is the least suitable, owing to the porosity of its surface.

To clean the glass, I know of nothing more suitable than a brand of soap known as "Monkey Soap," used only for cleaning non-destructible articles. After this the plate is well polished with clean chamois leather or old silk handkerchief. Now comes the critical point, *i. e.*, the application of the French chalk or powdered talc. This is the time when the operator may know whether his prints will stick or not. The chalk must be dry; a little spread on to the glass plate and rubbed all over with a pad of cotton wool; with the silk handkerchief it is then dusted off again. Now, what is the appearance of the glass? Does the chalk adhere still to any parts, forming white patches? If it does, the glass still remains imperfect and must be again washed, polished, and treated with the chalk. If the chalk is dry and the cotton wool in same state, the chalk should leave the glass by just drawing the handkerchief over it once or twice. When this is the case, you may squeegee your prints on with perfect safety, and if placed in a moderately warm room, they will not be long before they fall away from the glass with the required polish.

If they do not, however, all that is necessary is to insert a sharp knife under one of the corners, and they may be easily loosened. Above all things, make sure that the prints are perfectly dry before attempting to remove them. They often feel dry at the back, while the surface of the print, which is the most important part, and which, being furthest away from the air, is the longest in drying, is still damp.

Sometimes it happens that a portion of the picture is dry and will come away easily, but other parts stick and must be left to dry still more. This is always bad, as it leaves an ugly, ineffaceable mark on the print.

When the print is apparently dry it is always better to gently warm both sides of the glass before attempting to remove.

After the pictures are taken off, the glass may be used again if simply polished and dusted over with chalk, and the chalk again removed. If any of the powder be left on the plate, it will be afterward noticeable on the surface of the print. It is certainly a fact that the glass plate, after having been used several times, improves considerably, and it soon becomes a matter of difficulty to make the prints stick, should such a thing be required.

Instead of French chalk, other substances, such as wax or oil, can be used. If the plate be coated with a weak solution of wax in alcohol, there will be no difficulty in removing the prints. A little oil—one drop will be sufficient, rubbed over the plate with a piece of flannel—will have the same effect. There is, however, a marked difference between the surfaces of prints surfaced in this manner and those done with chalk, which in reality has the effect of making the glass thoroughly clean. The latter, of course, are much more brilliant.

Gelatino-chloride of silver emulsion prints do not require the same amount of washing as albumen pictures; it should be short and thorough. By thorough is meant the continual change of water, not only by a running stream, but by continually emptying the dish in which they are washed. If the prints be allowed to remain for a great length of time in water, the gelatine film becomes slightly decomposed and softens. This will cause them to adhere tightly to the glass, no matter how carefully it has been previously prepared. Therefore avoid prolonged washing, but do not err on the other side by washing too little, as the permanency of the prints will be seriously affected.

A few words might also be said upon the squeegee itself. The flat ones are undoubtedly the best, and far superior to the new-fangled roller absurdities. The India-rubber should be evenly cut, and neither too hard nor too smooth. In squeegeeing, never bear too hard upon the print, as the film is likely to be injured. All that is required is to remove all the air between the film and the glass; by reversing the glass this can be easily seen.

As a final remark, I would say: Never attempt to use artificial heat for drying the prints upon glass, except, as already stated, to give a final warmth after the prints have apparently dried spontaneously. It must be remembered that the gelatine film is a soluble one, and the image is easily destroyed by heat. Even if rendered insoluble by an alum bath, the effect of heat will be to cause the film to adhere firmly to the glass plate.—*W. K. Woodbury, Photographic Art Journal.*

The Earthquake in Japan.

In a recent letter to the New York *Tribune*, Mr. Kairiyama, a Japanese resident of New York, states he has received letters from Japan containing many particulars of the terrible earthquake in that country, which took place October 28. The section chiefly afflicted was the great island of Hondo, which is the main island of the Japanese empire, embracing many provinces. The surface of the ground at the time of the disturbances was terribly shaken. No person could stand. Houses were instantly thrown down, fire instantly raged, roasting the imprisoned victims. The shocks took place at intervals during four days and varied from 100 to 600 in different localites. Relief funds are being subscribed in this and other countries.

The London *Daily Graphic* says, "Twenty-six thousand five hundred people were killed and wounded, 90,000 houses destroyed, 200,000 people homeless. Not even the distance between them and us, which robs the facts of so much of their import, the figures of so much of their meaning, can deprive them of all. There are people starving too, and this is a tangible ill which one may attempt to lessen as well as to appreciate. An appeal has been made by the Japanese people to our charity. The disaster which has overtaken them it is not within human power to foresee or prevent, but some of the consequences it is only human to attempt to alleviate."

The steamer China, which recently arrived at San Francisco from Hong-Kong and Yokohama, reports that while the steamer was between Hong-Kong and Yokohama on the return trip to San Francisco an imposing sight was witnessed by the passengers and crew.

The great earthquake at Yokohama had taken place a short time previous, and many of the islands in the Yellow Sea were in a state of volcanic disturbance. About seven o'clock on the evening of November 3, the China was passing the Aleutian Islands, in Van Diemen's Straits, when suddenly the island of Sucoa seemed all ablaze, and flames and lava shot up to a distance of 800 feet in the air.

The steamer was twelve miles distant, and the spectacle, as seen from her deck, was grand. The night was dark and the eruptions from the crater of the volcano took place at intervals of about fifty seconds. They were accompanied by detonations which in the distance sounded like bombs exploding, and after each discharge of molten lava and flames the burning fragments descended like sparks from a gigantic Roman candle.

The American bark Hesper, also lately arrived at San Francisco from Kobe, Japan, after an excellent passage of twenty-seven days, reports a graphic account of an experience with a submarine volcano, hot sea water, and sulphurous gases.

Captain Sodergren states that about 6:45 A. M. on October 28, while lying at anchor in Kobe, the bark, received a sudden shock that caused the masts to strain and crack. Some of the standing rigging snapped like a piece of twine, and all hands were thrown from their feet. The vessel pitched heavily, and caused one of the crosstrees to break from its fastenings and fall on deck. The waters became still an hour later, and the bark put to sea.

Early on the morning of October 30, when about seventy-five miles off the Japan coast, the bark was almost thrown on her beam ends by the sudden eruption of a submarine volcano. The water became so hot that when a sea was shipped on deck, the crew took to the rigging. The heat became so intense that the pitch in the deck was melted and the seams opened.

"Great blasts of hot air with a strong sulphurous smell," said the captain, "would come up from the breaking surface of the ocean and almost suffocate us for the moment. Then the membrane of the nostrils became irritated, causing us all to have a fit of sneezing. This phenomenon lasted for several hours. I have had all I want of the Japan side for some time to come."

Professor Horace Briggs, of Buffalo, who was in Japan at the time of the earthquake, says immense crevices from which hot mud and steam escaped were to be seen in all directions.

Asbestos Rubber.

The new catalogue of Louis Wertheim, of Frankfort o/M., Germany, manufacturer of asbestos goods, contains some interesting facts regarding the history and uses of this peculiar material. Asbestos differs from nearly all other minerals in being fibrous and textile, dividing into fibers resembling in delicacy those of flax and silk, and can be spun and woven like any other textile fiber, giving a yarn or cloth entirely fire proof and acid proof. Although known in Egypt and elsewhere three thousand years ago, the practical use of this material in considerable quantities has been delayed to the present age.

The finer kinds of asbestos, which are pure white and silky with strong fibers, are comparatively rare and expensive (the same being free from silicic acid and metal oxides) and in consequence of their lubricating qualities are particularly valuable for technical purposes. These kinds of asbestos have only been found in Canada and some parts of the United States. The asbestos found in Italy, Switzerland and Germany is colored, gray and yellow and more compact. These qualities are much cheaper than the American; but being far inferior, their use has largely ceased.

Since the discovery of the American asbestos the use of the kinds previously found in Italy has largely fallen off. Asbestos mining in the remainder of Europe has, so far, amounted to little. The principal qualities of the American asbestos chiefly consist in being absolutely indestructible even when exposed to the action of any known acid and its possessing at the same time in the highest degree that peculiarity of a self-lubricator, viz., a soft, greasy or soapy feeling, which has brought plumbago, soapstone and chalk into favorable notice.

The use of asbestos in connection with India rubber is now practiced in various directions. Asbestos and India rubber woven sheeting, for instance, consists of asbestos woven cloth, coated on both sides with India rubber and then vulcanized. It is used as a substitute for the asbestos millboard for packing for steam joints and in other situations where it is desired to resist both heat and moisture, while affording a high degree of elasticity. Asbestos and India rubber woven washers are also made, and asbestos and India rubber woven tape, for making steam and water joints. Asbestos rolled cloth packing is made both with and without India rubber core. Asbestos block packing consists of an India rubber back, upon which there are built up edgewise a number of layers of asbestos cloth.

Sufficient elasticity is thus imparted by the rubber back, while great durability and protection to the rubber is insured by the use of asbestos.—*I. R. World.*

Refining Camphor in Japan.

A very important change has recently taken place in the methods of preparing camphor for market. The principal source of supply is in southern Japan, and for many years it has been exported from there in the crude state only. Recently, and since the great advance in the price of the drug, caused by its consumption in the making of celluloid, plants for the refining of camphor have been set up in Japan. In April last complete machinery, including stills, engines and boilers, were manufactured at Pittsburg, Pa., for Messrs. Gribble & Nash, of New York, and sent to Hiogo, Japan. The complete machinery weighed about fifty-five tons, and cost $75,000. Dr. A. G. Boyer, who had previously given much time and thought to devising improved methods of procuring the crude gum and refining it, went to Japan as the chemist in charge of the enterprise. Previous to setting up this plant near Hiogo, all camphor left Japan in a crude state, and was refined either in Europe or this country. This caused a great deal of waste from evaporation, and has prompted capitalists to do the refining where the drug is produced, and thus avoid the waste and loss which has heretofore attended its transportation. About the same time that this plant was sent to Japan, another one, purchased by native capital, was started. This shows how quickly the natives of Japan adopt improved methods of trade and manufacture, rather than be outdone by their foreign competitors.

The American refinery is composed of machinery made under the patents of W. F. Simes, of Philadelphia, and will be able to produce from fifty to seventy-five thousand pounds of refined camphor a month.

The products are of two kinds. One is sublimed, and called flowers of camphor, which slightly resembles desiccated cocoanut, except that it is of a gummy nature. The other kind is pressed into cakes of varying shapes and sizes, but generally about the size of a cake of toilet soap. The flowers of camphor is prepared especially for use in the manufacture of celluloid. Since the American refinery has got into successful operation, a company has been formed with a capital of $100,000 to prosecute the business.

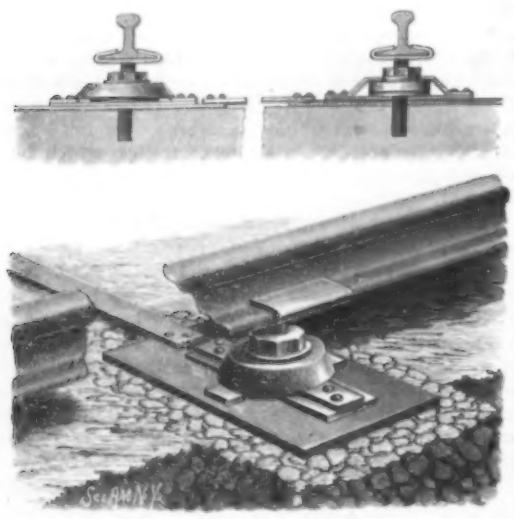
Just what effect the new method of refining camphor will have upon the price of the article seems to be a matter of considerable uncertainty, the market value having fluctuated greatly at times, owing in part to the manipulation of speculators and also to reports of its use in making smokeless powder and for other purposes. It is now said that camphor has proved unsatisfactory in smokeless powder, because it evaporates after the powder is placed in the cartridge.

The methods of procuring the crude camphor in Japan are of a very primitive character, though sufficient quantities are always forthcoming to meet the demands of trade.

As was shown in the SCIENTIFIC AMERICAN of June 6 last, camphor trees are being domesticated in this country, a large number of specimens having been distributed by the United States Department of Agriculture. A gentleman who has spent a number of years in Japan, and is familiar with the procuring of camphor gum from the trees there, said recently that he saw no reason why camphor should not, in time, be produced here in paying quantities.

AN IMPROVED RAIL SUPPORT.

The device shown in the accompanying illustration is designed to facilitate raising or lowering the rail to keep the track in proper alignment without disturbing the roadbed or ties. It has been patented by Mr. Charles M. Dyer, of Cloverdale, Ind. The tie is made of two plates, connected with each other by a transverse bar, as shown in the sectional view, and on top

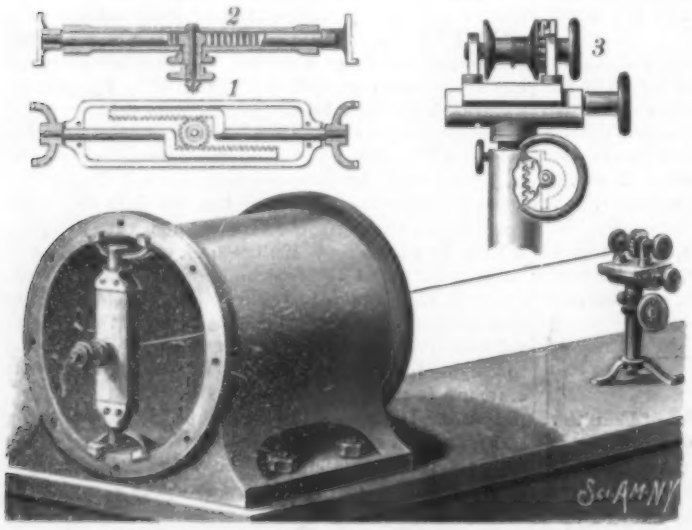


DYER'S RAIL SUPPORT.

of each of the plates is a casing in which is mounted to turn a nut engaging a vertical screw rod having on its upper end a clamp engaging and supporting the base of the rail. The upper end of the nut is adapted to be turned by a wrench or other tool to raise and lower the screw rod, thereby raising and lowering the rail, the foundation preferably being such that the screw rod will only need to be used to adjust small inequalities as may be necessary to keep the line in true and perfect alignment. The under side of the nut rests on a washer in the bottom of the casing, its lower end being formed with a flange to prevent its displacement in the casing and to distribute the pressure over a large area.

A GAUGE FOR USE IN ASSEMBLING THE PARTS OF AN ENGINE.

The improvement illustrated herewith, which has been patented by Messrs. George J. Hunt and Thomas F. McKechnie, is designed to obviate the necessity of the tedious work of calipering, as now practiced in assembling the parts of an engine. Adjustable heads having central openings, and adapted to be secured in the ends of the bore of the cylinder, are shown in plan and sectional views in Figs. 1 and 2, the cord holder to be used in connection therewith being shown in Fig. 3. In the casing of each head slide racks with rods extending in opposite directions through the ends of the casing, arms at the outer ends of the rods having each a lug adapted to abut against the end of the cylinder. The racks are in mesh with a pinion having a hollow hub, on one outer end of which is a nut to lock the hub and pinion in place after adjustment of the feet, while on the extreme outer end of the hub is a knob to turn the pinion to move the racks inward



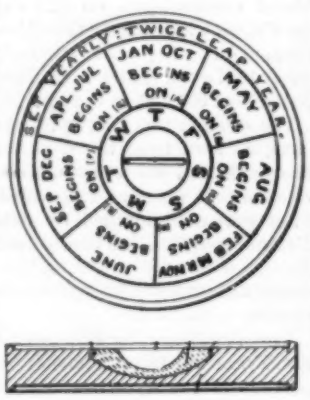
HUNT AND McKECHNIE'S GAUGE FOR ALIGNING ENGINES.

or outward, there being in the end of the hub a bushing with an opening to be used for sighting, or through which may be passed a cord. The cord holder has a hollow part in which slides a rod having on one side rack teeth, meshing with a pinion which may be turned by a hand wheel to move the rod up or down, there being a set screw to hold the rod in adjusted position. On the upper end of the rod is a frame with guideways in which slides a laterally adjustable plate, on top of which are standards carrying a spool, to which is attached the cord to be passed through the openings of the bushings in the heads, there being on one of the faces of the spool a ratchet wheel engaged by a pawl, whereby the spool may be locked in place when the cord has been drawn tight. By this quickly obtained vertical and lateral adjustment the cord can be brought to the exact axial line of the cylinder, and the other parts of the engine can be readily laid out or set on a frame to be in proper alignment therewith, the slides for the crosshead, the bearings for the main shaft, etc., being at once located in the proper place.

Further information relative to this invention may be obtained by addressing Mr. George J. Hunt, Sapperton Post Office, New Westminster, British Columbia, Canada.

A SOUVENIR OR MEDAL CALENDAR.

The illustration represents a simple device, to be made as a souvenir or pocket piece, slightly larger than a silver dollar, and which will indicate the days of the month, week, and year, as well as the dominical days, needing to be set but once in ordinary years and twice in leap years. It has been patented by Mr. William W. Kitchen, of Rockford, Ill. In the top side of the piece is a recess to receive a revoluble center portion as shown in the sectional view, the initial letters of the days of the week appearing on this portion. The disk is divided into seven radial spaces adapted to register with the letters on the center piece, the spaces being inscribed with the names of the several months, the names of two months appearing in some of the spaces, and the dominical letters being also arranged in the disk spaces to indicate the Sundays in the year. The center piece is rotated so that the day of the week thereon upon which the year comes in will be in line with the space in which January appears, the letters appearing opposite the other months then indicating the first day of each month. By this means any day may be quickly found, and it is only necessary to set the center piece back one space to set the calendar for the ensuing year, except in the case of a leap year, when it is necessary to reset the center piece on the 29th of February or 1st of March. On the outer portion of the disk is a space on which may appear directions for use, or any suitable motto or inscription.



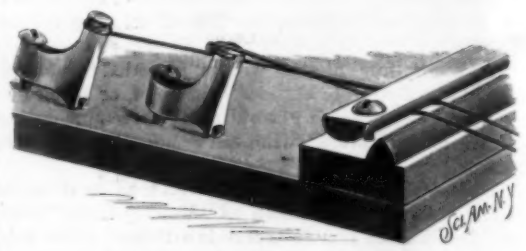
KITCHEN'S PERPETUAL CALENDAR.

Trade Marks—Form of Packages.

The Supreme Court of Pennsylvania recently rendered a decision in regard to trade marks which will interest our readers. The case was that of E. W. Hoyt & Co., Lowell, Mass., *vs.* F. Hoyt & Co., Philadelphia, both manufacturers of cologne. As shown by the testimony, E. W. Hoyt & Co. put on the market in 1871 what they called "Hoyt's German Cologne," the same being put up in 25 cent and $1.00 bottles. They subsequently brought suit against F. Hoyt & Co., of Philadelphia, who had been in the cologne business since 1868, praying for an injunction to restrain the latter from using the name "Hoyt's" on cologne. Evidence was offered by F. Hoyt & Co. to show that they were established in the cologne business in 1868 (that is to say, previous to E. W. Hoyt & Co.), that they originated the 25 cent and $1 bottles in 1869, and used the word "Hoyt's" on their labels in that year. The Supreme Court, reversing the decisions of the lower courts, held that E. W. Hoyt & Co. had no claim to the use of any particular kind of bottles, that they had appropriated Dr. Jayne's cap label (originated by him in 1863) and that the size, shape, or mode of construction of a box, barrel, bottle, or package into which goods may be put is not a trade mark, and if a manufacturer has a right to use a certain label, he may use it on any kind of bottle that is not patented, and he will not be restrained from combining his own label with a particular shape or style of bottle for the mere reason that the latter has been previously adopted by some other producer of similar goods.

AN IMPROVED PIANO TUNING PIN.

We herewith illustrate a new style of piano tuning pin, which is designed to do away with the general and well known trouble of having pianos get out of tune. The invention consists principally of a metallic bell crank lever, to one end of which the string is fastened, while to the other end of the lever is applied an ordinary machine screw, by means of which the



FASCHER'S PIANO TUNING PIN.

string is tuned with an ordinary screw driver, with the utmost ease and exactness, the fulcrum of the lever being formed by a pin or other suitable projection inserted into or cast integral with the main iron frame. The tuning pins being thus fastened directly to the main frame of the piano, the wrest plank, or pin block, is entirely dispensed with, and after the strings have once become thoroughly set in all their bearings, they will remain in tune and in pitch for an almost indefinite length of time without further tuning. This invention has been put to a practical test by the inventor himself, he having constructed a piano for this purpose, and it has stood this test thus far for over two years. Its simplicity, the ease and exactness with which a string may be tuned thereby, and its staying-in-tune qualities, are advantages claimed for it over the old style tuning pins. Besides this, the dispensing with the wrest plank, which heretofore was one of the principal parts of a piano, will considerably simplify piano construction.

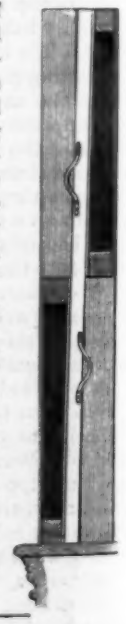
For further particulars relating to this improvement address the inventor and patentee, Mr. Hermann Fascher, St. George, Utah.

The American Chemical Society.

The fourth general meeting of the above society is to be held in this city on the 29th and 30th of the present month. Committees of finance, entertainment, etc., have now been appointed, and the local members are actively engaged in doing everything possible to make the meeting a success. The society, formerly almost limited to this vicinity, has now been nationalized, and local branches are already established in a number of cities. The impending general meeting, it is anticipated, will bring together many of the leading chemists of the country, and will undoubtedly do much to increase the standing of the national organization. In addition to the social features, important papers on chemical subjects are expected, and there is little doubt that the occasion will be even more memorable than the last Newport and Washington meetings. Dr. Durand Woodman, 80 Beaver Street, New York, may be addressed with reference to the meeting.

SCHMIDT'S IMPROVED WINDOW FRAME.

This patented improvement was illustrated and described in the SCIENTIFIC AMERICAN of November 10, but an incorrectly worded sentence rendered the description somewhat erroneous, although the illustration plainly represented the efficiency and simplicity of the device. The parting rail in the slideways, as shown in the accompanying picture, is placed in a slightly diagonal position, so that when the sashes are closed they will be firmly wedged in position to exclude air and prevent rattling, while in the upper portion of the slideway of the lower sash and the lower portion of the slideway of the upper sash a spring is placed in a recess in the parting rail, by means of which, when either sash is pushed to the wider portion of its slideway, it will be held at any position in which it may be left. The obvious convenience and the extreme simplicity of the device will be readily apparent. The improvement has been patented by Mr. August Schmidt, of No. 1768 Amsterdam Avenue, New York City.



Intense Cold.

By the subjection of common air to a pressure of 1,125 pounds to the square inch, or 75 atmospheres, with a condenser kept at —135° C., the air is reduced to liquid form; and the liquid, when allowed to evaporate, produces a temperature of —200° C. This is within 73° of absolute zero, which is —273° C.

IMPROVED RAPID FIRING GUNS.

Modern artillery, which has already been so greatly improved in regard to power and range, has just taken another step, that is in rapid firing. With old guns that were charged through the mouth, five or six minutes were required for sponging out the piece after each shot, charging, placing in position and taking aim. Breech loading simplified these operations by reducing the time required for them to about one minute. One shot a minute! Only ten years ago this was marvelous; to-day a cannon is fired ten, twelve, and even fifteen times per minute, and each shot throws a projectile weighing from 40 to 80 lb. (according to the caliber) a distance of nearly seven miles. Each one of these projectiles is capable of piercing a wrought iron plate 20 inches thick.

How has the cannon been thus changed into a veritable mitrailleuse? It has been done by utilizing the force of recoil. Heretofore, the effect of this force was to throw the gun and its carriage violently backward, making it necessary to replace them afterward. As they are arranged to-day, said force serves to replace the gun, after each shot, in its initial position.

The accompanying figures, which represent the carriage and the rear part of a marine gun, will aid us in giving an idea of the mechanism employed.

The carriage, which is entirely of steel, is not now mounted on rollers or rails. It is firmly bolted to the bridge of the vessel. Only the cannon recoils. It can move back and forth over a distance of about 15 inches, in a frame comprising two supports, L, forming slideways. This frame rests on the carriage by means of two pivots, on which it oscillates for taking higher or lower aim. We know of no better way of making this comprehensible than by comparing it with a telescope, of which the cannon proper is the interior tube, the supports, L, take the place of the exterior sheath, while an intermediate tube is represented by a sleeve, M, which covers the rear part of the firing tube and

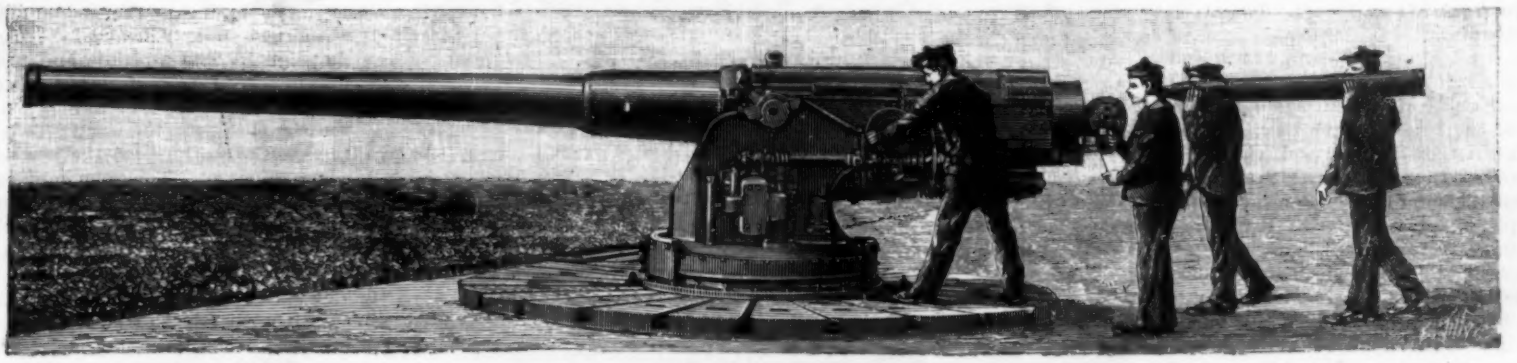


Fig 1.—MARINE GUN—LEFT SIDE.

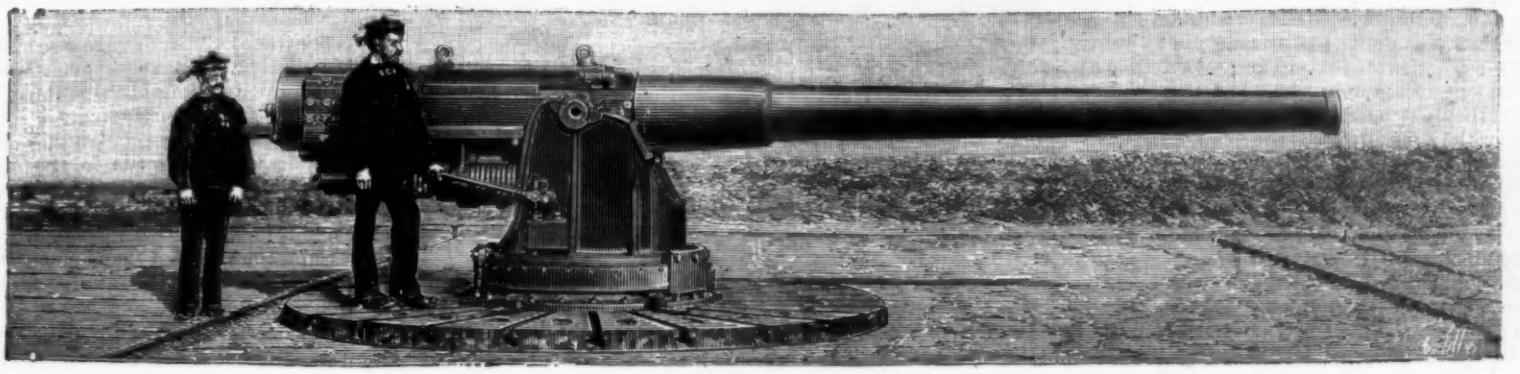


Fig. 2.—MARINE GUN—RIGHT SIDE.

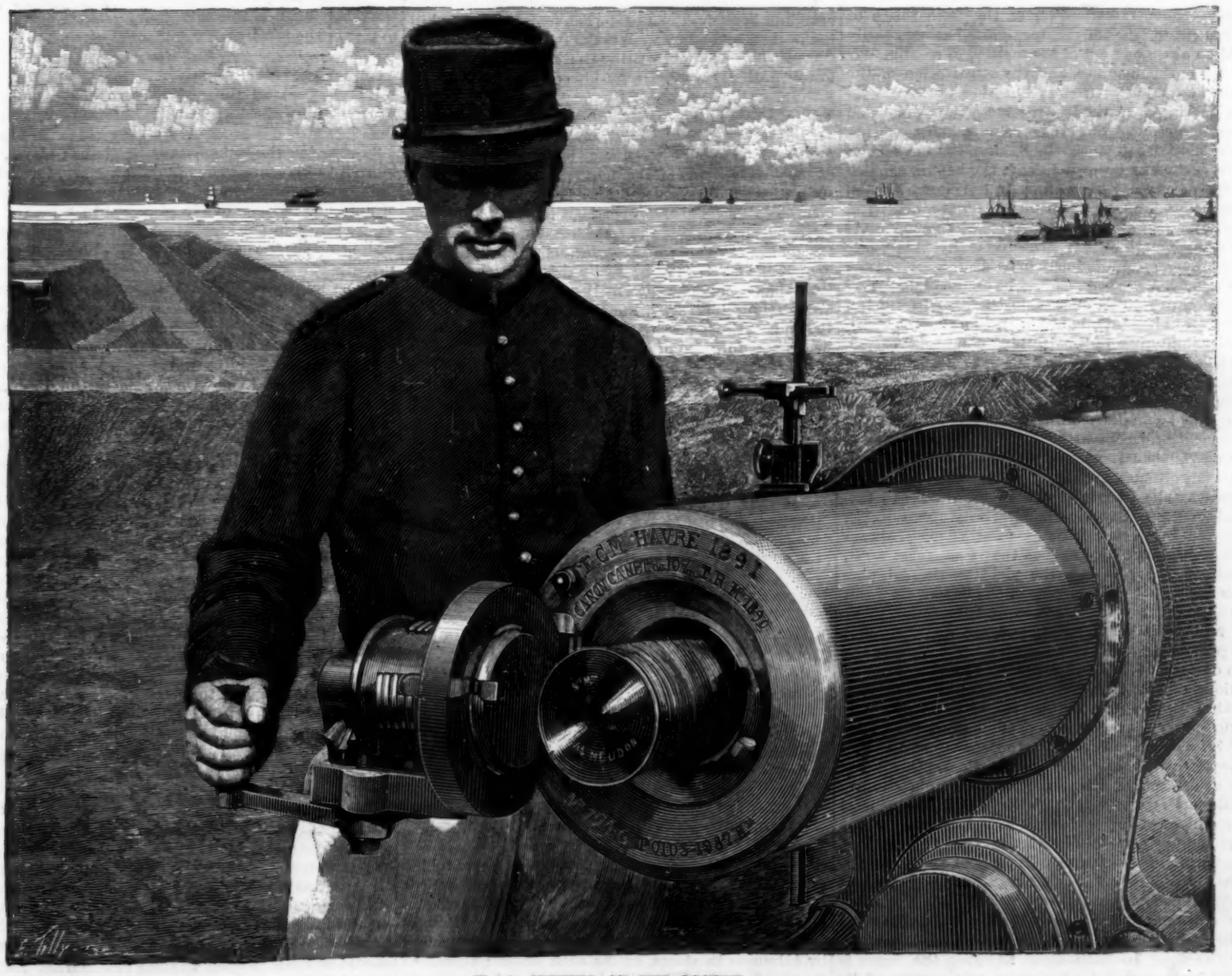


Fig. 3.—OPENING OF THE BREECH.

IMPROVED RAPID FIRING GUNS.

which slides between the supports, L. This sleeve recoils with the gun, of which it forms a part, as shown in the two accompanying figures, and in this backward movement it draws with it a system of rods placed on the gun and acting on powerful springs. These springs, which are compressed by the recoil, push the gun forward again when they expand. But if this movement was left to them alone, it would be too violent and sudden. To regulate this they have been connected with the piston of a pump filled with glycerine. They have to force the liquid from one side of the piston to the other through little holes pierced in it, and the diameters of these openings can be regulated as desired. Thanks to this hydraulic brake, the rude force of recoil is transformed into a gentle and precise return movement.

The drawing of the entire gun gives an idea of the length of the new cannons, which is not less than 40 or 45 times the caliber, so that a gun which has an interior diameter of 5 inches will be, for example, about 20 feet long. It will also be seen that the mechanism of *fermeture* is much simplified, all being accomplished by one movement of the hand. Attempts have been made to produce this movement automatically by the recoil, and with a certain success, but at the cost of great complication, on account of which it has been given up.

The new guns receive cartridges with a copper shell containing the priming and the powder, and arranged on the projectile. Except for the dimensions and the weight, they are exactly like the cartridges for the guns carried by the soldiers. The cartridge shells are extracted automatically by the movement of the breech mechanism. The manipulation of the gun is so simple that only five men are required to operate it.

France, England and Germany are now constructing rapid firing guns, but France seems to possess the most perfect system, for the Russian Admiralty has just adopted it, after long trials in the works of Krupp and Armstrong.—*L'Illustration.*

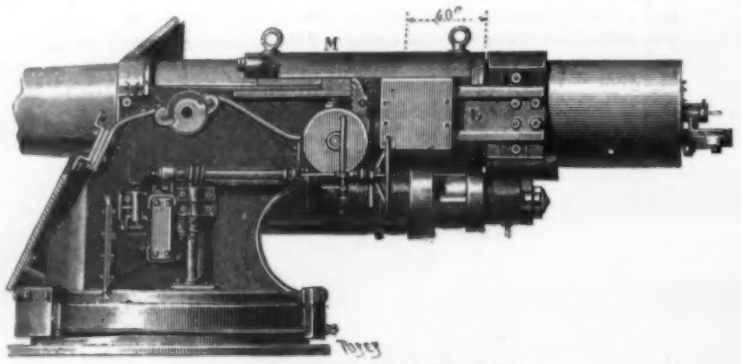


Fig. 4.—THE GUN AFTER RECOIL.

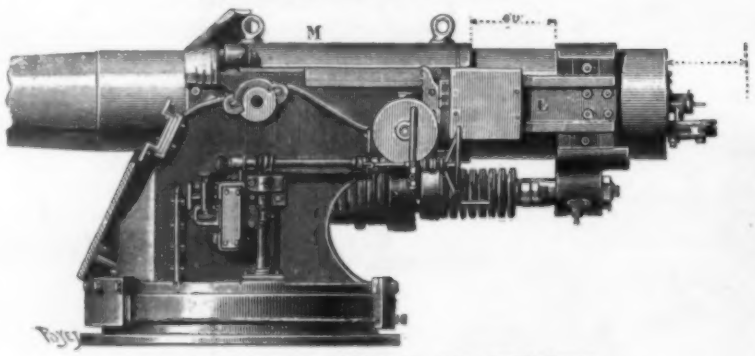


Fig. 5.—THE GUN REPLACED FOR OPERATION.

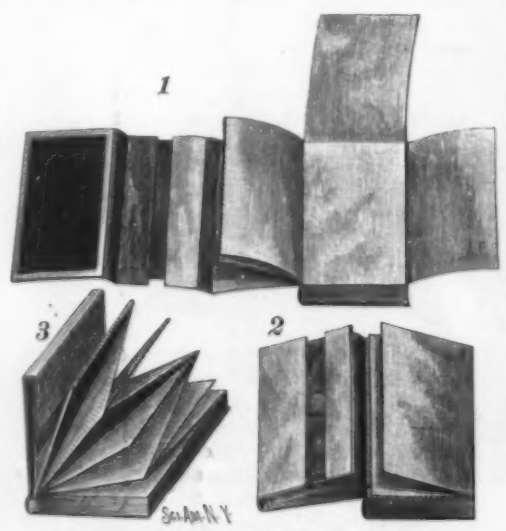
IMPROVED RAPID FIRING GUNS.

Roast and Baked Meats.

The very general adoption of the close range or "kitchener" in place of the open grate has necessarily caused an abandonment of the method of roasting our meat before the open fire, and the substitution of the process of baking in a close chamber or oven. No doubt the latter method is the most convenient and the most economical, but it may be questioned whether it is the most wholesome. In baking, the meat is, as it were, cooked in its own juices; the vapors exhaled from the warm meat are confined in the close oven and do not escape into the atmosphere, adding, no doubt, to the flavor and also to the richness of the food. At the same time, the joint surrounded by this dense vapor does not yield its juices so freely as when roasted in an open atmosphere, as can be seen by comparing the yield of dripping obtained in the dish in which a leg of mutton has been baked with the amount which a similar joint gives to the dripping pan when roasted. That a very large quantity of the more oily portion of the fatty matters, especially of the fat distributed between the muscular fibers, does not leave the meat when baked can be shown by examining a slice of baked meat and comparing it with a similar slice of roast meat, when it will be seen that in the former minute oily globules are abundantly distributed among the fibers, while in meat that has been well and thoroughly roasted they are comparatively unnoticeable. Moreover, the gravy from baked meat when cut always yields more grease than does that from roast meat, though, as above stated, the yield to the dripping pan is less with the former than the latter. It is this retention of the volatile aroma and unctuous juices that renders baked meat so popular, and no doubt with persons of strong stomachs it is not harmful; but when digestion is feeble, we are convinced it is highly injurious, and that its continued use not only aggravates but also induces indigestion, and that in many instances very considerable benefit has resulted from the advice of the medical man to the patient to order his meat to be roasted instead of baked. Our knowledge at present regarding the respective digestibility of different fats is very imperfect; still, the general and popular opinion is that the more oily fats are less digestible and more "bilious" than the solid, and it is these fluid fats which form the grease of cooked meats. Much the same may be said regarding the mode of cooking bacon. Thus in the north of England thick slices of bacon are placed in shallow tins and cooked in the oven, while rashers are usually fried in a pan over the fire. In both cases, however, the bacon is cooked in its own "dip," or most oily portion of its fatty matter. It has long been pointed out that bacon cooked by either of the above methods is a "bilious" article of diet, whereas when bacon is toasted it is not apt to disagree even with decidedly "bilious" people, the reason being that the oily portion of the fat or "dip" is removed, and only the more solid fat left. We have no wish to raise a panic with regard to the useful and economical "kitchener," but would merely suggest that baking may in some instances be the unsuspected cause of indigestion, in which case a return to the use of the roasting jack and the open fire would, we think, prove to be a step in the right direction.—*The Lancet, London.*

A CONVENIENT MEMORANDUM BOOK.

The illustration represents a handy form of memorandum book designed to be conveniently carried in the pocket, and adapted to make triplicate copies of a transaction by simply writing the record in the book in the ordinary way. It has been patented by Mr. Samuel J. Silberman, of No. 79 Canal Street, New York City. Fig. 1 shows the book fully opened, the various leaves tipped back, Fig. 2 representing it in position for use, and Fig. 3 showing the arrangement of the leaves. One of the covers is connected by a strip with a flap to which is attached a frame carrying a carbon sheet, and the permanent leaves of the book are connected at their outer edges to detachable leaves, the connection being by a perforated line, so that the detachable leaves may be easily torn out. A strip of tissue paper is wound spirally through the entire book, as best shown in Fig. 3, the strip being perforated at the ends of the leaves, so that a leaf of this paper may be torn off for each of the other leaves used. In use the carbon sheet is folded inward upon the permanent



SILBERMAN'S MEMORANDUM COPY BOOK.

sheet, and one of each of the detachable leaves folded upon it, when the memorandum made will appear upon one of the permanent leaves of the book, and on two leaves to be detached, for the use of the customer, and the cashier of the house, when the book is used by salesmen in stores, or for such other purpose as may be desired. When the book is closed, the carbon frame is always in position for use, and serves as a book mark.

The New York Fire Department.

The opportunity to inspect the New York fire system was afforded recently to the members of the New York Electrical Society, who visited the Fire Alarm Telegraph Headquarters, 157 East Sixty-seventh Street.

Superintendent Smith led the way to the fire alarm telegraph room. Here he explained and illustrated the way in which alarms are given. When an alarm has to be sent, the box stationed at the nearest street corner is opened and the hook inside is pulled down and let go. This winds up the "automatic," which immediately starts into motion, and a series of signal repeating devices come into play. Its object is to insure the communication absolutely in case of any failure of the first signal. The certainty and promptness of transmission of alarms is secured beyond all chance of failure. When once the signal is sent, the wonderful perfection of the working of the system becomes apparent. The same impulse that conveys the alarm rings a bell in the bunk room of the firemen and releases the trips which hold the horses in their places in the stalls on the ground floor. The horses are so splendidly trained that they trot smartly to the pole of the engine the instant they are released, and are poled up in a second or two. So that in point of fact the firemen are ready to dash out of the station before the alarm has been completed.

The duties of the fireman are so exacting that he must be sound, wind and limb, and on the thoroughness of the work in the gymnasium much of the efficiency of the service depends. From here descent was made to the ground floor, where the evolutions of the horses and preparations for starting on the receipt of an alarm were witnessed.

Supt. Smith asked the company to adjourn to the call box at the corner of Sixty-eighth Street and Park Avenue, nearly a quarter of a mile distant from the station. Here an alarm was given. In less than a minute the lights of the engine were seen rapidly approaching, and within a minute and a half the hose was playing on Park Avenue, and the life-saving corps were raising the revolving, movable extension ladder, which is used to rescue the inmates of a burning building.

The Value of Isochromatic Plates.

Mr. G. Cramer, the well known plate maker of America, puts the isochromatic question very clearly, thus:

"Let us imagine a landscape before us; above, the blue sky with white clouds; on the horizon, the distant hills; in the foreground, foliage in the beautiful shades of autumn. The ordinary plate would take the sky white, being just as sensitive to the light blue as to white rays; and, therefore, will show no clouds unless they are of a darker shade. The distant hills would only be faintly visible, and the foliage be lacking in detail. The orthochromatic plates would give us a soft, gray sky, not white, but with beautiful white clouds; the distant hills just as distinct as you see them in reality, and the foliage, with all the various gradations, from the finest high light to the deepest shadow, every leaf being clearly detailed, and every blade of grass standing out from the rest. In all it gives us just what we see with our own eyes, except the colors. For portraits, we will consider we have to photograph a pretty, rosy-cheeked girl from the country—rosy-cheeked, but a little freckled, with a blue dress and yellow trimmings, and with auburn hair. The ordinary plate will give her a fair face, but what a job to retouch all the freckles! The blue dress will appear like a light one, the yellow trimmings will be too dark. Her hair will show a great lack of detail, and appear the same as black hair; while the other plate will give, if anything, a bolder, rounder image. Freckles will not be visible to a greater extent than you can see them with your eyes, and, in the portrait, are generally smaller than the original, as they are almost entirely invisible. The hair will be of a medium shade, and as full of detail as that of a brunette. The dress will be of a proper tone, the yellow trimmings in harmony with the rest."

What Shall be Done with our Molasses?

The undivided attention that is now required of every sugar planter to enable him to successfully harvest the present cane crop is diverting attention from the question involved in the caption of this article. It will come up again at the end of the season with as great a force as ever, and it would seem well even now that it should have consideratio and that every effort should be made to open up some new market for this large fraction of our sugar crop. There is now a practical loss of the entire value of the molasses to all vacuum pan houses.—*La. Planter.*

THE MONTEREY.

The new double-turreted, twin-screw, armored coast defense vessel illustrated on our first page was launched in May last, at the Union Iron Works, San Francisco, and is now fast nearing completion. She is designed to afford a floating defense of the highest character for the magnificent harbor of San Francisco, while also available for similar service anywhere on the coast, and would probably have been named after the principal city, had not this name been already given to a new cruiser. As it is, she takes the name of the coast town which was the capital of Upper California when the territory was taken possession of by the United States, more than forty years ago.

The bids for the construction of this vessel were opened April 3, 1889, the Cramps, the Quintard Iron Works, and the San Francisco Union Iron Works being competitors, the contract being awarded the latter firm on their bid of $1,628,950, with the provision that $100 will be paid for every unit of horse power over the stipulated amount, and $100 deducted for every unit less than this.

The Monterey is of the low freeboard type, presenting but little surface to receive the fire of an enemy's guns, and has a curved steel deck to give her further protection. She is constructed entirely of steel, and has a double bottom throughout, with 110 watertight compartments in her hull that can readily be filled with water, submerging the vessel until only about one foot of her sides shows above water. Her displacement in ordinary condition is 4,000 tons, but in fighting trim it will be 4,486 tons. Her general dimensions are: Length over all, 261 feet; on load water line, 256 feet; extreme breadth, 59 feet; mean draught, 14 feet 6 inches. She will have an armor belt which is thirteen inches thick amidships, diminishing at the bow and stern, the maximum thickness extending over the steam machinery and the ammunition.

The engines of the vessel are designed to give 5,400 indicated horse power, with forced draught, with which it is expected she will show a maximum speed of fifteen or sixteen knots, and be able to carry sufficient coal to travel over 600 miles at this speed, her coal endurance at the rate of nine knots per hour being designed to allow her to cover a distance of about 2,700 miles. She has no sail power, her single military mast being solely for observation and signaling, and to carry machine guns and a search light. The propelling engines are triple expansion, the cylinders being 27, 41, and 64 inches diameter, respectively, and the stroke 30 inches, there being two of these engines, designed to work the twin screws at a speed of 150 revolutions per minute on a steam pressure of 160 pounds per square inch. There are two main steel boilers, 11 feet 2 inches diameter and 10 feet 7 inches long, each, and four smaller tubular boilers. The fire room is under pressure to give the forced draught when that is required, and the ventilation throughout is effected by a large blower, doing away with all funnels. The hatches are closed by hydraulic cylinders. The electric light plant consists of three units, each unit embracing an engine, dynamo, and combination bed plate, and several search lights.

The armament of the vessel is to be as follows: Two 12-inch breech-loading rifled guns, with 13-inch steel armor protection and steel shields eight inches thick, each firing a projectile weighing 850 pounds, with a powder charge of 425 pounds; two 10-inch breech-loading rifles mounted en barbette, with 11½-inch steel armor protection and steel shields 7½ inches thick, each firing a projectile weighing 500 pounds, with a powder charge of 250 pounds. There are also to be six 6-pounder rapid-firing rifles, four 37-millimeter Hotchkiss revolving cannon, and two 1-pound rapid-firing rifles.

The Union Iron Works, where the Monterey is being completed, has for a long time occupied a leading position in the manufacture of mining machinery, and was in 1885 moved to South San Francisco, where, on a tract of fifteen acres, a great plant has been established, as is attested by their highly successful work in building government war vessels. The dimensions of their great stone dry dock are as follows: Length of excavation in solid rock, 450 feet; depth, 120 feet; width of entrance, 30 feet; width of top, 120 feet; capacity of pumps per hour, 325,368 cubic feet. Its cost was $675,000. Henry T. Scott is president and treasurer of the corporation, and Irving M. Scott is vice-president and general manager.

Soldering Aluminum.

The inventors claim that surfaces of aluminum may be successfully soldered to each other, and to other metallic surfaces, by using silver chloride as a flux in conjunction with ordinary solder.

The pieces of metal, one or both of which are aluminum, are placed in the relative position required in the joint, finely powdered fused silver chloride spread along the line of junction, and solder melted on with a blowpipe or other device. The joints are thus easily and rapidly obtained, and become hard and perfectly sound on setting, and neither crack, flake, nor check. —*F. J. Page and H. A. Anderson, Waterbury, Conn.*

Correspondence.

Missouri Marble and Onyx.

To the Editor of the Scientific American:

As a country editor, I have for many years read your paper and taken a deep interest in the scientific information contained in each number.

This county of Missouri is, as you will see by examining a map, situated right in the Ozark Mountains.

I have observed of late, in the current literature of the day, a good deal said about marble and onyx rocks, and much comment upon their economic value. My object in writing is to ascertain whether there is at this time a market for these rocks. I am tolerably well posted in the geology and rockology of this region, and have made a specialty of examining and exploring caves, which are very numerous here, and I find that there are extensive and almost exhaustless deposits of both marble and onyx here. The onyx is of several kinds and colors, and looks to me as if it was of good quality for working into ornamental work of any kind. Some of it is in caves and some shows outcroppings on the mountain sides; some is white as snow, some water-colored, and some red, and contains different colors in strata like agate. The best marble is commonly red or brown, some is gray and dove-colored. I would like to correspond with any one commercially interested.

TRUMAN S. POWELL,
November 23, 1891. Editor *Oracle*, Galena, Mo.

Flow of Water in Subterranean Channels.

To the Editor of the Scientific American:

There have been in this immediate vicinity, driven or bored, about a dozen artesian wells. They are on the flats bordering the river (Rappahannock), and as the water rises only 8 or 10 feet above the level of the river some of them will scarcely come above the level of the ground; hence the water will usually come no higher than the discharge pipe. Now the mooted question is, What causes the water in these pipes to ebb and flow with the tides? It is not *observable* in wells that have their discharge pipes 5 or 6 feet below the highest water point, but very perceptible in those that are cut within a foot of their usual gauge. The average ebb and flow of the tide is about 20 inches. The extremes are over 4 feet. My theory is that it is not a gas but a water pressure that lifts or forces the water, that the water within the earth ebbs and flows with that on its surface, being affected by the same physical laws; but the most peculiar part is that when we have the extremes in the tides which are caused by the winds alone, we also have a corresponding extreme in the well. This may be caused by mass attraction—the greater the mass of water on the surface, the greater the attraction. But the puzzle is, from where does the water pressure come? If from some distant elevated position, the main body could not be affected by the mass attraction, for it is far away, but only the little stream in the well.

The water comes from a depth of about 240 feet, and seems to be between strata of rock. Can it be that this water has some connection with the water from the elevated ridge, which is about two miles distant and about 50 feet high? If so, there ought not to be much variation of pressure. Please give any information on the above that you can in your columns.

P. YATES BARBER.
Sharp's Wharf, Richmond Co., Va., Nov. 17, 1891.

[The subterranean water, like surface water, always flows toward a lower level, which is found along streams, bays, and the ocean. The pressure is nearly constant, except in rainy seasons, when the whole substratum rises and contributes its rise to the wells. Along the margins of these water plateaus that are near tide water the tides affect the level of the water in the wells by blocking the freedom of flow, just as a dam backs the water in a sluggish stream. The underground water in your district flows from the high land toward the river at an angle equal to the general rise in the land, being held back by the friction of the sandy strata through which it passes. This controls the angle of descent.—EDITOR.]

Science of Making and Tempering Steel.

To the Editor of the Scientific American:

Some of the very best cast steel made is often condemned by ignorant and careless workmen in both forging and tempering. Take, for example, a mill pick for picking burr millstones, and I have seen blacksmiths, when forging, upset the edges that are to be tempered for cutting these very hard stones, either being ignorant of the structure of forged cast steel or not considering the injury that they were inflicting upon that metal.

When cast steel is melted and cast into ingots, all of the particles are of globular formation (round), and there are open spaces between all these diminutive globes. In forging, these globes are elongated and welded more closely together and pointed at the ends proportionate to the amount of forging or elongating which they receive. If you examine the cutting edge of a razor with a powerful magnifying glass, you discover that the edge is toothed like a fine saw. If in forging that razor the forger hammers the edge, then grinds and finishes it as it is left from the forge, he will find a most irregular toothed razor edge, one tooth flat or blunt and another peaked and sharp, the pointed edge of the very sharp one liable to break off or crumble as he saws off his beard, for that is what the barber does when he shaves you. He saws your beard off. In upsetting the mill pick you blunt up these sharp points and crowd one against another, so that when you harden the point it is very likely to start an invisible crack at the cutting edge which enlarges at each jar from a blow on the stone, and a corner flies off.

And still another ridiculous idea is that it must be hammered off until quite cold, so as to refine the steel. I have found that the very best results come from heating carefully to a good chery red, forge the tool out while quite red, and cut the end off, and never upset a mill pick or chisel or any cutting tool intended for hard service. In hardening a mill pick or cold chisel, never plunge it into the hardening bath suddenly to a given point, because the shrinkage will be at a fine given point, while the part above is a trifle larger, and a crack is liable to start at this very point. Run the edge or point to be hardened into the bath rather slowly and above where the temper of the tool is needed and raise it out in the same manner. Wood coal is preferable for heating such tools, because it throws off carbon and contains no sulphur or other base substances injurious to steel. In forging wide cutting tools, hammer the cutting edge last, so as to expand that part a little the most, as this will prevent it cracking at the edge when hardened.

In making chopping axes for hard frozen timber, after they were forged in the regular way under a trip hammer, I always had them carefully hand-forged at the cutting edges and never allowed the smith to upset the cutting edge.

J. E. EMERSON.

Feeding the Sick.

To the Editor of the Scientific American:

It is a fact beyond all question that there is a progressive loss in weight in all cases of acute sickness until a normal appetite is regained or death occurs. Not all the resources of medical science have thus far served, perhaps, in the least, to avert this loss.

If foods cannot be so "handled" by the sick as to prevent this waste, is it not barely possible that they are not digested and assimilated? Is not this inference still stronger in the light of the numerous cases on record (and in the experience of every physician) where life has been sustained for very long periods without any ability to take food, perfect recoveries ultimately occurring?

Either nature has been guilty of an enormous blunder in causing such intense aversion to all ordinary foods, when the need to "support the strength" seems so pressing, or enforced feeding is a blunder.

Except in the use of milk, it is not possible to administer any food in quantities to meet the seeming need. But is milk a fit food for any case of severe sickness or in any case where the appetite is lost? It is safe to assert that not a hundred families in America would or could object to its use in any case when prescribed by a physician. It is, perhaps, as safe to assert that not a hundred intelligent families would *not* object to feeding their sick the equivalent of the milk ration in tough curds, *swallowed whole*. Milk is reduced to the form of tough curds at one stage of digestion; hence it would seem that it should always be administered, if at all, in this form to the sick in order to be duly masticated; fine particles certainly being more easily digestible than large masses. But who would feed curds to the sick, even if milk is the highest type of food, and particularly if they have been soaked in brandy or whisky? There is nothing in curds or even in milk that appeals to the sense of *taste* in a well marked case of hunger. No one, not even the strongest, could enter upon a course of diet of milk or milk and whisky or brandy without an immediate impairment of strength, because of its difficulty of digestion. Is a stomach enfeebled by a general disease any better able to so digest as to maintain strength?

The writer has not given milk in any case of acute sickness for many years. This withheld, there is little danger of other foods being enforced to an undue taxing of the stomach; the uniform aversion to all solids being the safeguard. He has found it entirely safe, even in fevers, to await the normal appetite before feeding; the reliance for maintaining the strength being on the tissues, aided by such drinks as nature calls for with no obscure language. And a striking thing has been observed in cases so treated, and that is, an increase of strength as the acute symptoms subside, and while still on tissue support. Whatever of seeming absurdity there may be in this statement, the fact is clearly within easy reach of demonstration by any who have care of the sick.

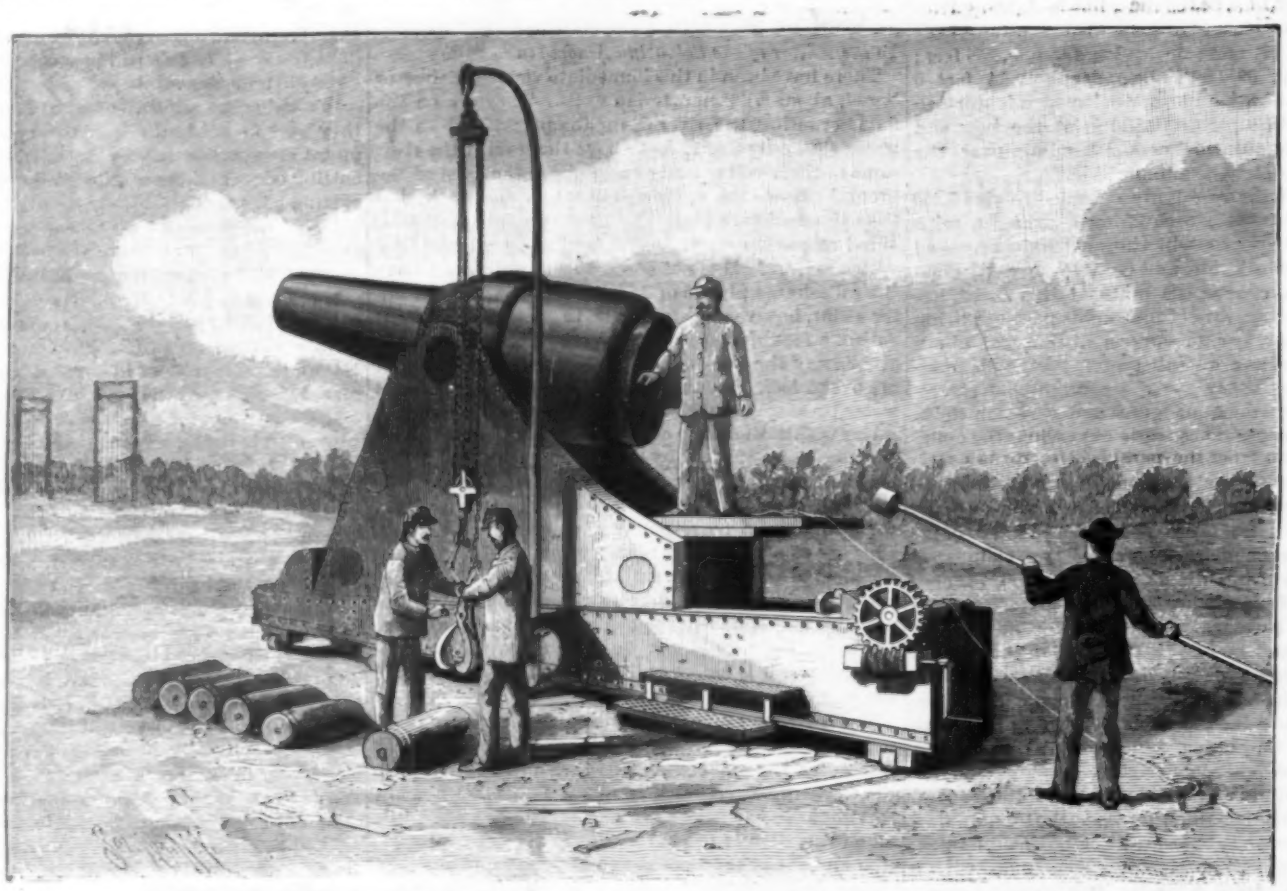
A rigid adherence to this method has not been attended by such fatality as to excite public attention.

E. H. DEWEY, M.D.
Meadville, Pa., November 27, 1891.

OUR NEW 12-INCH MORTARS.

The coast defense system planned for the protection of our large cities is being gradually worked out, although but little has yet been completed in this distinctive line as compared with what has been effected in building up our new navy. Several of the new monitors, as the turreted vessels with low freeboards are styled, are, it is true, approaching completion, and all of these are primarily designed for purposes of harbor defense, but in connection therewith it is the intention to defend the principal cities by a great number of mortars, located in groups at the most advantageous sites commanding harbor approaches. The plan is to establish such batteries below the surface of the ground, at places separated by considerable distances, each group to contain sixteen mortars, arranged in four pits, four mortars in each pit, and all of them adapted to rain down explosive shells upon the decks of an approaching hostile fleet, the range of the vessels having previously been accurately determined by a concealed observer, and communicated electrically to the mortar pits.

One of these new mortars, of which a number are now ready, forms the subject of the accompanying illustration, the mortar being employed at the Sandy Hook proving grounds, just below the entrance of New York Harbor, in testing various kinds of powder. Tons of new powders and explosives come to the Hook for tests through the year, being stored there in four magazines which have been constructed in a great unfinished granite fort, which was begun before the war and never completed, such forts being no protection against the guns now used. The most of the powders tested are provided in accordance with the specific directions of the government engineers, and a large proportion of them are made at one of the Dupont establishments. In mortar firing especially, where the discharge is always to be at high angles, it will not do to have a powder which gives an initial velocity to the projectile of only 1,875 feet per second, when its velocity should be 1,975 feet per second, for upon the accurate gauging of this velocity, in connection with the angle of elevation, the determination is made of the exact point at which the projectile should again reach the earth. Of course there is always some variation, due to numerous causes, but the accuracy with which such shots can be made has been well tested, and it has been proved that a vessel 330 feet long and 60 feet wide can be hit sixty-seven times out of a hundred at a distance of over five miles, and ninety times out of a hundred at a distance of two and a half miles, supposing the vessel to be stationary.



FIRING THE 12-INCH MORTARS AT THE SANDY HOOK PROVING GROUNDS.

In the experiments now being conducted, the main object is to determine the initial velocity of the projectile with varying charges and different lots of powder, gauging also the pressure produced within the gun. For this purpose some very delicate instruments are employed and most elaborate computations are necessary, but the actual record is made in such a simple manner as to be readily understood. Two wire screen frames are set up in front of the gun, the first frame at a distance of about 150 feet, or far enough away not to be affected by the shock of firing, and the second one at a measured distance of 100 feet from the first. The wires in each of these screens form a complete electric circuit, including a battery and magnet. When the projectile breaks the wire in the first screen the circuit is interrupted, releasing an armature, the armature connected with the second screen being similarly released by the passage of the projectile, the very short interval of time between the dropping of the two armatures, although almost inconceivably brief, being accurately registered by a chronograph. The armature connected with the first screen consists of a suspended iron rod about three feet long, which falls as the screen is broken, and the armature connected with the second screen is arranged to operate, when released, as a knife, striking the falling rod and making a mark thereon. The distance through which the rod drops while the shot is passing from one screen to the other is indicated by the distance of the cut from the end of the rod, and from this the interval of time is computed, several chronographs being used to test the same shot when great accuracy is desired.

These mortars are rifled breech-loaders, with cast iron body and steel hooped, weighing 14¼ tons each. They are more like short guns than the old fashioned mortars, and are of the French type with breech-loading mechanism of the interrupted screw De Bange style. They are 129 inches long and 31⅛ inches in diameter, tapering down to 23½ inches at the chase, or forward conical part, while the diameter over the hoops is 41¾ inches. The iron is charcoal pig, the castings being made vertically, breech downward, and cooled by the circulation of water through the core. The first contracts for these mortars were made with the Builders' Iron Foundry, of Providence, R. I., for the mortar bodies, and for the finishing and assembling, the Midvale Steel Company furnishing the steel hoops and forgings. The face plate at the rear is a banjo-shaped piece dovetailed to the breech block, and turns it in and out of mesh with the interrupted thread by means of a crank and gear running in a circular segmental rack. A translating roller moves the breech block in and out of the breech recess, and a spindle fitted loosely in the center of the breech block has a two-tenths of an inch hole drilled through its entire length, through which are inserted the primers to explode the charge. By turning two cranks the breech block is unlocked and withdrawn, when the projectile is raised by a crane and shoved in, and afterward the powder, in one or more canvas bags, the block being returned to its position by the translating roller crank handle and locked by the revolving gear handle, whereby the vent is uncovered for the insertion of the primer.

It has been proposed that the hollow projectile to be discharged from these mortars shall be filled with a mild form of nitroglycerine. It is probable that a variety of explosives will be tested, to insure obtaining one of the highest degree of effectiveness consistent with safety in use. As such shells will, instead of striking the heavy armored sides of a battleship, fall upon her thinly armored deck, it is estimated that their destructive effect will be greatly beyond anything heretofore accomplished.

The Limits of Taste.

According to Prof. Venable's investigations, the following parts of a gramme can distinctly be tasted when put upon the tongue:

Sugar	0·008
Salt	0·000
Tannic acid	0·0008
Muriatic acid	0·0000
Saccharine	0·000008
Strychnine	0·0000048

Large Panes of Glass.

The largest plate of glass in this city and in the State is in the Eleventh Street window of Robert J. Thompson, at the southwest corner of Eleventh and Chestnut Streets. The size of the plate is 8 feet 4 inches by 16 feet 8 inches, and it was manufactured at Kokomo, Ind. The firm which had the contract for furnishing the glass first placed its order with a Pittsburg company, which was unfortunate enough to break two plates of that size in preparing them for transportation. There are several others which nearly equal this one in size. There is one 194 by 100 inches, another 140 by 144, and one which was recently replaced, an infuriated bull having gone through its 198 by 98 inches. The largest plate of glass in the country is in stock at Kokomo, and is 16 feet 8 inches by 11 feet 8 inches.—*Philadelphia Record.*

A Curious Experiment in Food Preservation.

It has long been known that the most perishable kinds of food can be preserved for long periods by freezing. In the arctic regions, where the natural temperature favors such a course, freezing is relied on to preserve meat for months at a time. The introduction of artificial freezing processes has caused freezing to be utilized in our own more southern latitudes with greater or less success for the same object.

A test of the question of food preservation by the above means was recently brought to a striking conclusion. A few days ago, Mr. Edward R. Bell gave a dinner at his residence in this city. As guests there were present Rev. Morgan Dix, D.D., Rev. Halsey Knapp and some other friends. The primal object of the gathering was to test the palatability of a turkey which had been killed ten years ago, and which had been kept frozen ever since. Mr. Knapp had been the custodian of the bird during all those years. The turkey was prepared as a part of the dinner.

It was found that the fowl was perfect in shape, and without taint of any sort, but its meat was utterly tasteless and void of all the flavor and juices proper to a well roasted turkey. The fat and juices had entirely disappeared, leaving only bone and muscular fiber. The prevailing impression as to the inferiority of frozen food products was fully borne out by this interesting experiment. It is known that freezing impairs the flavor of meats, fish, and vegetables, and while it arrests decomposition it does not entirely prevent evaporation and desiccation.

Housekeepers who are particular about providing the best beef, fowls, and provisions in general for their tables are very apt to avoid the purchase of any products which have been frozen. For reasonable periods food is kept by cold without freezing, and this is virtually the action of our domestic refrigerators. Absolute freezing with preservation through one or two seasons is not to be commended.

Rubber Foot Fever.

If a man has a corn, says the *India Rubber World*, it can be removed, but if he is suffering from rubber foot fever, no chiropodist can help him, and the only thing to prescribe is liberal bathing of the feet and removal of the cause. Rubbers should only be worn to keep wet out, and they should be removed the moment the wearer gets indoors. Failure to note this gives a man wet feet in a far worse sense than if he had waded through mud ankle deep. It was the trouble resulting from forcing the perspiration to soak the stockings and keep the feet perpetually damp that drove rubber-soled boots out of the market. Even loose rubbers are a source of danger and the cause of many more serious colds than they avert.

A LUMINOUS WATERFALL AT THE LATE FRANKFORT ELECTRICAL EXPOSITION.

It is well known that great interest and curiosity were excited by the luminous fountains at the Universal Exposition of 1889. An exclusively electrical exposition could not fail to present a similar spectacle, and in the exposition at Frankfort-on-the-Main there was a luminous waterfall, the working of which we will explain. The large figure shows the grotto and the waterfall as arranged. On the floor of the grotto is a dragon which throws out water in waves. Near the grotto are two towers; the first of these is ornamental, while the second, which is visible in our engraving, contains the lighting apparatus. The latter rises from a lake having a surface of 5,085 square feet and a depth of about eight feet. This lake is fed from the Main by means of pumps. The water is raised to a reservoir on top of the grotto and feeds the waterfall, which forms cascades, as shown in our illustration.

Fig. 1.—LUMINOUS WATERFALL AT THE FRANKFORT EXPOSITION.

The lighting devices used for producing the luminous effects are very interesting. The different apparatus are scattered, as much as possible, among the rocks. The small view shows the principal arrangements employed. It represents the method of illuminating from underneath the water which falls over the rocks. In front of a parabolic mirror is an automatically regulated arc lamp, the rays of which are thrown on inclined mirrors, which reflect them, through colored glasses, either upon other mirrors that reflect them again, or upon prisms. The object of this arrangement is to force the luminous rays to follow the undulations of the water as much as possible.

The front surface of the water, at the moment of its fall, is also lighted; and for this purpose a similar lighting device has been employed. Here also a parabolic mirror is used, an arc lamp is placed in front of it, and colored glasses are placed in the paths of the luminous rays, the glasses being changeable at will. All the rays fall on a second mirror, which is curved and slightly inclined, so as to send the reflected rays back to different points.

For lighting the smaller parts of the waterfall, direct lighting by means of flat mirrors is employed. The parallel rays coming from the parabolic mirror fall on a flat inclined mirror and are reflected parallel, passing through glasses of different colors. After a second reflection the rays pass directly through the water. The luminous rays also pass through the water that comes from the mouth of the dragon, to which we referred in the first part of this article, so that the monster seems to be vomiting fire. Two hundred and seventy-six amperes were employed for the different arc lamps used in this interesting arrangement. The electricity was supplied by a special electric station.—*La Nature.*

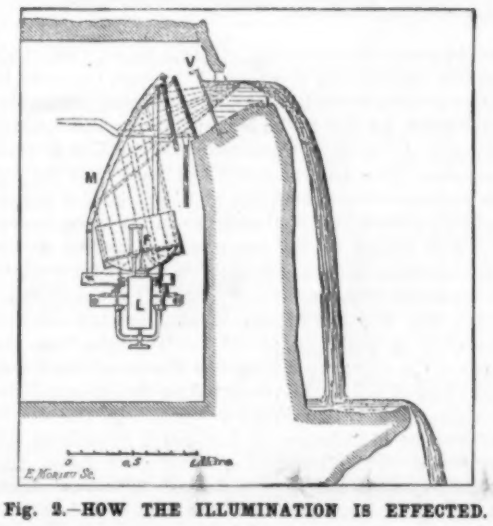
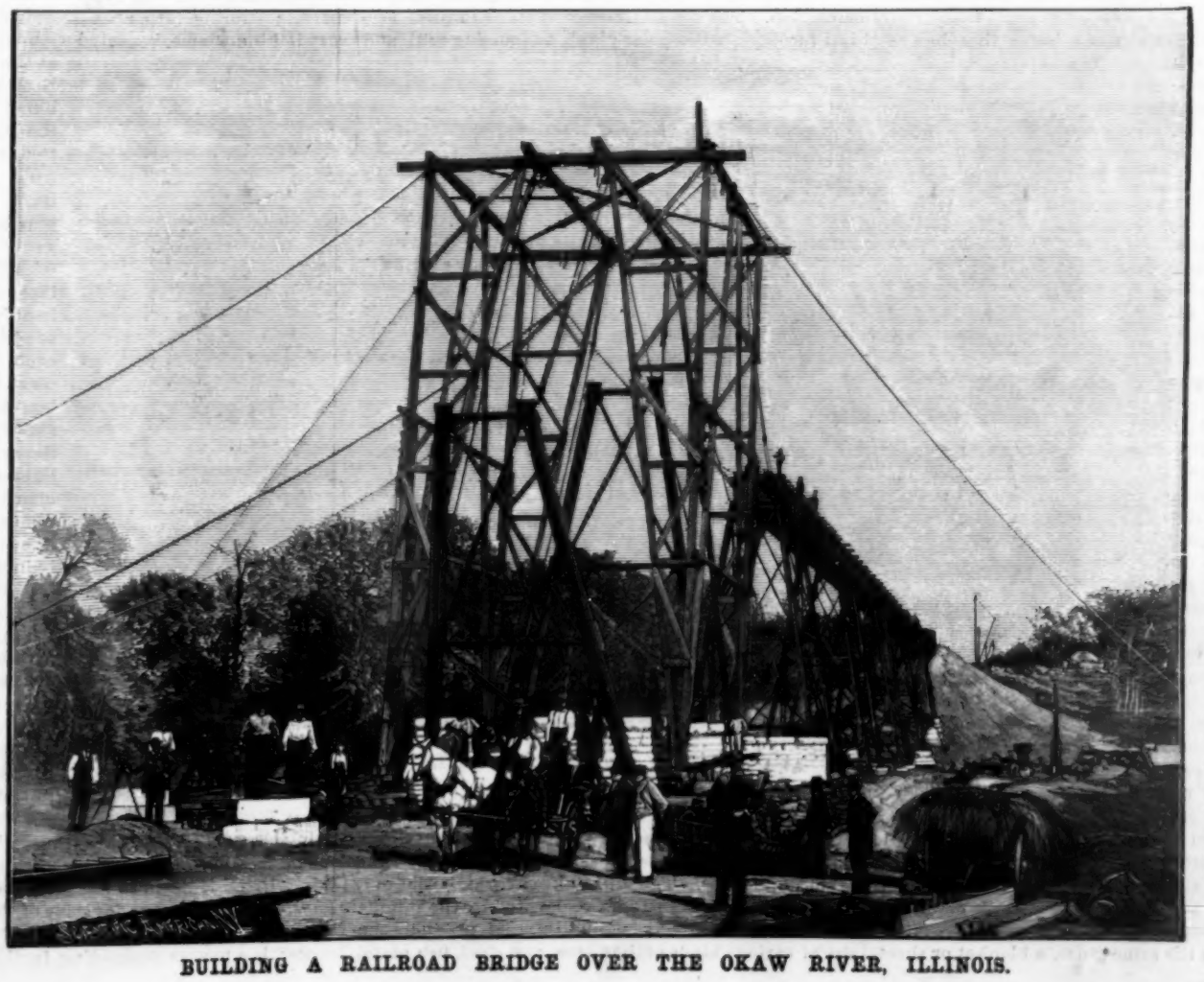


Fig. 2.—HOW THE ILLUMINATION IS EFFECTED.

L, Electric Lamp. F, Voltaic Arc. M, Parabolic Mirror. V, White glass placed before the colored glasses.

THE OKAW RIVER BRIDGE, ILLINOIS.

Our illustration gives a good idea of one of the methods in which the work of building railway bridges is now carried on, where the structures are of considerable magnitude. It represents one of the numerous bridge building jobs constantly being undertaken by the Pencoyd Bridge Company, of Pennsylvania, the work shown being on the C. and E. Railroad, between Sullivan and Shelbyville, Illinois. The carrier placing the iron trusses in position is a high and strongly braced but light frame, which can be readily moved along as the work progresses. It is of sufficient size to take the whole height of the main trusses, and afford means for their proper handling. In our view, which is taken from a photograph, it may be seen that two of these trusses are being placed in position at the same time, the frame, as it is moved along, being supported upon temporary foundations. The bridge is 1,392 feet long and 65 feet high, over bottom land for most of its length, its river span being 100 feet long and 75 feet high. Cost, about $95,000. It is the longest bridge in the State. We are indebted to Messrs. Martin Brothers, the well known photographers of Bethany, Ill., for photographs of this interesting work.



BUILDING A RAILROAD BRIDGE OVER THE OKAW RIVER, ILLINOIS.

Granite Cement.

Dr. J. Takayama, of Japan, has been investigating the properties of decomposed granite sand as applied to building purposes as a mortar. Large quantities of this decomposed granite are found in Japan, and, when mixed with slaked line, become as hard as European puzzolana and trass. The finest portion of the sand forms a fine, yellowish powder, in appearance like china clay of good quality, and, when mixed with lime, is hardened like natural volcanic tufa. The percentage of silica varied between 44 and 53. The finer portions were easily dissolved with hydrochloric acid. Dr. Takayama attributes the hardening with lime to the formation of aluminates and silicates of lime. A mixture of 10 parts of slaked lime to 100 parts of sand was found to give, on the whole, the highest tensile strength. Briquettes made with that mixture, after two weeks' exposure to the air, gave a strength of 56·89 pounds per square inch, and by fifteen weeks' exposure the strength was raised to 85·76 pounds per square inch.

The same mixture gave the best results when the test specimens were placed in water during hardening, the tensile strength being 7·54 pounds per square inch after two weeks, and 111·65 pounds per square inch after fifteen weeks. One specimen, however, consisting of 100 parts of slaked lime and 100 parts of sand, had a tensile strength after twelve weeks of 119 pounds per square inch, but the strength declined during the next three weeks. The lime mortar would not stand immersion in salt water, the author attributing the fact to the solvent action of the magnesium salts present in salt water. When the surface of the briquettes was smooth all the mixtures resisted the action of frost except the one containing the smallest amount of lime, *i. e.*, 3·41 lime to 100 sand; but when the surface was roughened by scratching, the 10 to 100 mixture was the only one not acted upon, although frozen and thawed five times.

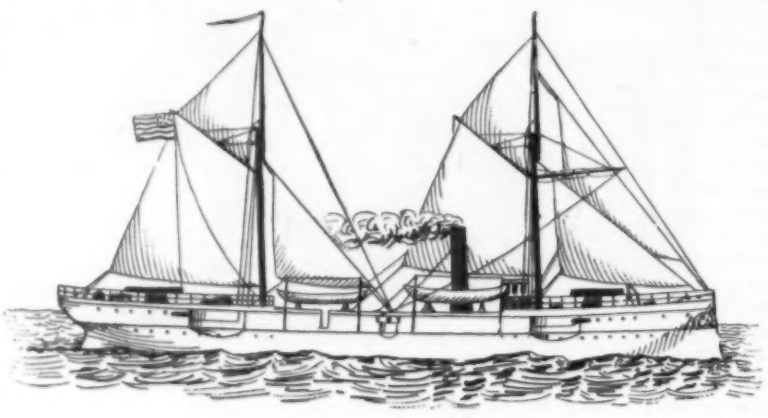
Transatlantic Routes.

A uniform route across the Atlantic for all steamers leaving Liverpool for New York, and another separate route for steamers leaving New York for Liverpool, have long been regarded by the large steamship companies, and by all thoughtful persons interested in the North Atlantic trade, as a pressing need of the time. A conference of the principal companies trading from Liverpool to New York has resulted in an agreement upon such routes, and the steamers of the Cunard, White Star, Inman and International, Guion, and National companies will now follow them. The tracks being fixed by common consent, represent the safest courses which the combined wisdom and experience of the lines adopting them can suggest. They do not materially affect the length of the passage, which will vary from 2,900 miles between January and July, to 2,775 miles between July and January, when the North Atlantic is comparatively free from icebergs.

THE first German university was at Prague.

RECENT ADDITIONS TO THE NAVY.

In our paper of December 5, we illustrated the new cruiser Detroit, 2,000 tons, launched October 28, at Baltimore, and on December 12, we gave an engraving of the armored cruiser New York, 8,000 tons, launched at Philadelphia December 2. On December 5, the cruiser Montgomery, 2,000 tons, mate to the Detroit, was launched at Baltimore. Her cost is not to exceed $612,500, and her dimensions are: Length on mean load line, 257 feet; extreme breadth, 37 feet; depth from main deck beams to keelson, 19 feet 7½ inches; constructed of steel of domestic manufacture; to be completed in May next; guaranteed speed seventeen knots, with a premium of $25,000 for each quarter of a knot in excess of the guaranteed speed. Motive power two triple expansion engines, direct acting, and with vertical inverted cylinders, with an estimated collective horse power of 5,400. Armament eight 4 inch and two 6 inch rapid-fire breech-loading rifles, four 6 pounder and four ounder rapid-firing guns, and two 37 millimeter revolving cannon. The torpedo outfit will be two torpedo ports under the poop, two under the forecastle, one through the stem and one through the stern. These are to be fitted with the Howell launching apparatus, and Howell torpedoes will be carried.



THE NEW GUNBOAT MACHIAS.

Another ship of smaller dimensions, the Machias, was launched at Bath, Me., December 8. Our engraving, for which we are indebted to the New York *Recorder*, shows the general style of the vessel. She is one of two gunboats each of 1,050 tons displacement, authorized by Congress in March, 1889, at a cost of $318,500 each. This was for the hull and machinery only. The total cost of the Machias is estimated at $474,726.34, including armor, battery, and the permanent outfit.

The principal dimensions of the Machias are as follows: Length of mean load water line 190 feet, extreme breadth 32 feet, depth from main deck beams to keelson 17 feet. Her armament will consist of eight 4 inch breech-loading rifles, four 6 pounder and two 1 pounder rapid-firing guns and two Gatling guns. The vessel and her machinery and boilers have been built of material of domestic manufacture—that is, everything is the product of American soil and workshops.

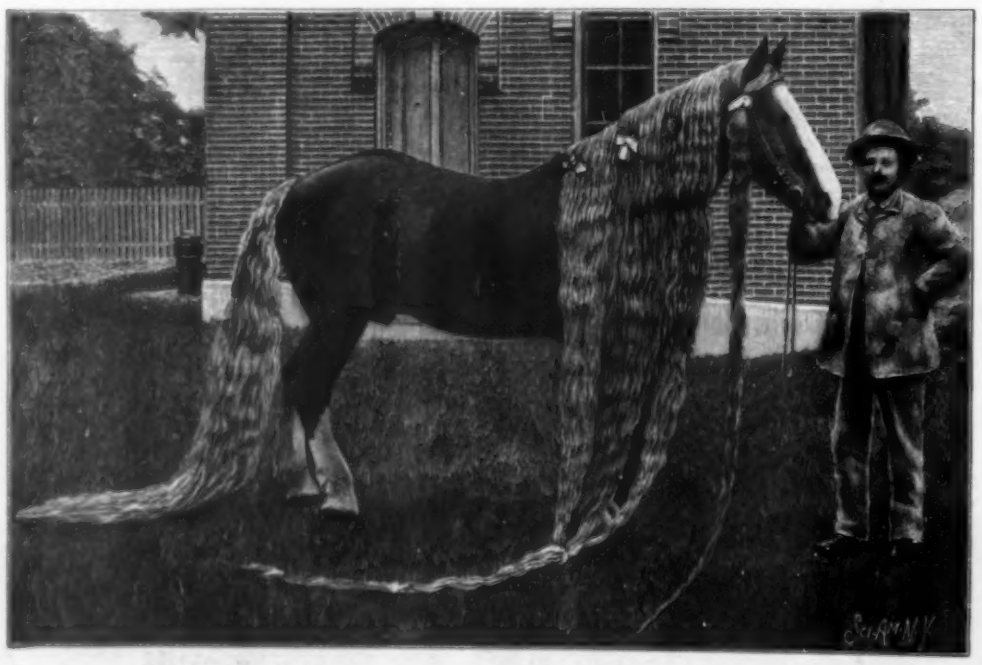
It is guaranteed by the contracts that her speed shall average thirteen knots an hour, maintaining it successfully for four consecutive hours, the vessel to be weighted to a draught of twelve feet. A premium of $5,000 is to be allowed for every quarter of a knot made in excess of the thirteen knots, and for every quarter of a knot she shall fail of reaching the guaranteed speed $5,000 is to be deducted. Should she fail to make twelve knots, she is to be rejected.

WONDERFUL GROWTH OF HAIR OF HORSE'S MANE AND TAIL.

We publish an illustration of a horse that has recently attracted much attention for the extraordinary development of the hair of his mane, forelock and tail. The animal is very handsome.

It is a stallion of French or Percheron, Printer and Clydesdale blood. He is 16 hands in height, weighs 1,435 pounds, and is of chestnut color. The mane and tail are of the same hue. He is now eight years old and was foaled in Marion Co., Ore.

The mane is fourteen feet, the foretop nine feet, and the tail twelve feet long. When spread and drawn out to their full extent, the display of the beautiful locks of bright hair is quite impressive. The greatest care is taken of the hair. It is washed out with cold water, no tonics being applied to it. Before the horse is placed in his stall the hair is drawn out and divided into several thick strands. From his mane four such strands are made. Each strand is then tied around once every six inches about to the end. It is then rolled up and put into a bag. For his mane and foretop alone five bags are required.



WONDERFUL GROWTH OF MANE AND TAIL OF A HORSE.

He is exercised in the same guise, a blanket or sheet, if necessary, being thrown over him to conceal the pendant bags. The greatest care is taken of his health. He is exercised every day, either in a ring or out of doors under the saddle. The owners will not permit him to be taken into the upper floor of any building for fear of some accident. During the last two years his mane and tail have grown about two feet.

The Illinois Steel Company.

The Illinois Steel Company was organized and incorporated under the laws of that State May 1, 1889. This immense corporation was formed through the consolidation of three of the largest manufacturing companies of the West, namely: The North Chicago Rolling Mill Company, Joliet Steel Company, and the Union Steel Company. The Illinois Steel Company has an authorized capital of $50,000,000, and includes five manufacturing plants, rich coal and ore lands, coke ovens, etc. The plants of the company are known as the North Chicago Works, situated in the northwestern section of the city, on the north branch of the Chicago River; the South Chicago Works, located on the shore of Lake Michigan, about twelve miles from the center of the city; the Milwaukee Works, at Bay View, an environ of Milwaukee, situated on the shore of Lake Michigan; the Union Works, located in the southwestern part of Chicago, on the south branch of the river; and the Joliet Works, situated at Joliet, Ill., about forty miles south of Chicago. Of these plants the South Chicago Works is the largest and newest, having recently been remodeled and enlarged, and consists of eight blast furnaces, a Bessemer plant with three vessels, blooming mill, rail train, an open hearth steel plant and plate mill about to be erected, harbor docks, etc. The ground surface covered by these works is over two hundred acres, and the entire plant is thoroughly provided with every appointment that could be desired, while its shipping and transportation facilities are unexcelled, having both water and railroad connection. The North Chicago Works comprise two blast furnaces, a Bessemer plant, a blooming mill, and a rail and structural steel mill, with finishing shops. The products of these works consist of steel rails, beams, and slabs. The Milwaukee Works is the only plant of the Illinois Steel Co. devoted to the production of manufactured iron, and its chief products consist of various kinds of bar iron and steel, fish plates, light rails, nails, etc. The company's Union Works comprise four blast furnaces, converting works and rail mill, and the product consists entirely of rails; while the operation of the Joliet Works produces rails, billets, wire rods, angle bars, girder rails, etc. These works are composed of three blast furnaces, a Bessemer plant, rail and billet mills, wire rod mill, foundry, air furnace, etc. A noteworthy feature of these works consists in the provision of a large and handsome club house, with swimming bath, gymnasium, etc., for the use and pleasure of the employes. The five plants of the Illinois Steel Company occupy an approximated area of five hundred acres of ground and the coal lands consist of 4,500 acres in the Connellsville district, on which there are 1,150 coke ovens, besides other lands in West Virginia. Between ten and eleven thousand men are employed in the service of the company and over $6,000,000 are annually paid out in wages.

The company have sixty miles of standard and seven miles of narrow gauge railroad in the yards of the various works, while the transportation of products and material requires the use of 500 cars and 42 locomotives, exclusive of 17 narrow gauge engines required in hauling special trucks. They own 1,500 cars which are used in the coke trade, besides 150 in ore traffic. The affairs of the Illinois Steel Company are officered by gentlemen celebrated throughout the financial, commercial, and manufacturing circles of the world, and this is indeed a corporation of whose magnitude every American should feel proud. The company owns nineteen blast furnaces, and has an annual productive capacity of over one million tons of pig and spiegel iron. When rolling rails at its South Union and Joliet plants simultaneously, it can produce 75,000 tons per month. Among the representative Chicago men who are stockholders and directors are to be found Marshall Field, H. H. Porter, Norman Williams, and others equally well known.

Fluorine Flames.

In connection with the research that is being made into the problem of the production of light by other means than by combustion, it is of interest to remark some of the experiments of M. Moissan upon the gaseous element fluorine, which he has recently succeeded in isolating. Fluorine seems to answer to that ideal conception of the old alchemists—the universal solvent. It possesses most intense chemical activity. The gas is obtained by electrolysis, conducted under a variety of ingeniously devised conditions necessitated by the corrosive nature of the product. Many different sorts of flames are produced by allowing fluorine gas to come into contact with other elements. With hydrogen, combination takes place explosively even at a temperature of −23°, and in the dark. If a tube delivers fluorine into an atmosphere of hydrogen, a very hot blue flame, bordered with red, at once appears at the end of the tube. Bromine vapor combines with fluorine in the cold, with production of a very bright, but low-temperature, flame. Iodine gives a pale flame; phosphorus and arsenic combine with fluorine with lively incandescence. Carbon in a finely divided state combines with fluorine even at ordinary temperatures. Purified lampblack inflames instantly with great brilliancy, as do also the lighter varieties of wood charcoal. The amorphous variety of boron likewise ignites instantly in fluorine, with projection of brilliant sparks; but the most beautiful of all these extraordinary displays of chemical activity is the reaction between fluorine and silicon. The cold crystals immediately become white hot, and then burn with a very hot flame, scattering showers of stars in all directions. Many other substances burn in fluorine, according to details published by M. Moissan in the *Annales de Chimie et de Physique*. The reason for some of the flames produced being of low temperature, though of high illuminating power, is a matter demanding further investigation.

RECENTLY PATENTED INVENTIONS.

Engineering.

FURNACE. — Emilio De Strens, Rome, Italy. This is a furnace designed to afford a high temperature by the use of any kind of solid fuel, especially that containing a large proportion of slag, its action not being interrupted by the feed or in cleaning. It has an upper and a lower fire chamber, the fuel being all fed to the upper chamber, and falling partially burned to the lower chamber, while the products of combustion from both chambers pass rearward to a mixing chamber, whereby perfect combustion is insured and no smoke produced. The draught is downward through the upper grate and upward through the lower grate, the incoming air in the latter case being highly heated before reaching the place of combustion.

FURNACE.—Chauncey R. Burr, Boston, Mass. This invention consists principally of two grates located one above the other, the upper one forming a fuel feed and a hot air supply for the lower one, the grates being hollow and diverging from each other from front to rear. The space between adjacent bars of the upper grate is also greater at the front end than at the rear, while the grate bars of the lower grate are parallel, and when the furnace is in operation the fuel on the upper grate is raked or agitated so that it falls upon the burning fuel on the grate below, through which there is also a downward draught from the upper grate.

Railway Appliances.

SWITCH. — Matthew Charlton, New Haven, Penn. This invention relates more particularly to an automatic switch for use in mining sections, where it is desired to switch one car on one track and the next car on another track, the cars being run in series in an uncoupled state. Switch rails are pivoted between and form part of the main and side rails, the switch rails being connected with each other and adapted to contact simultaneously at their diagonally opposite ends with the main or side rails, and as each car forces the forward end of the switch track into proper position to guide that car it sets the rear end of track to throw the next car upon the other track.

METALLIC TIE.—Albert G. Budington, Austin, Texas. This tie has a broad base and is hollowed out on the sides to render it as light as possible, while a rib extends at the top its entire length. In this rib near each end is a transverse dovetail recess to receive the rail, the inner sides of the recesses opening into similar but deeper recesses adapted to receive kegs fitting upon the rail flange. The kegs are held in place by pins, and the rails may be quickly and securely fastened in place. Provision is also made for holding double as well as single rails in this form of tie.

METALLIC TIE.—Jacob C. Wolfe, New York City. This tie is preferably made of cast metal, and a series of interior transverse ribs or webs connects the sides, the ribs or webs extending flush with the upper edges of the sides and ends, while the upper faces of the ribs adapted to support the rails have longitudinal beads or tables. The construction is somewhat similar to that of the metal bodies used for electrotyped printing plates, whereby a durable tie may be economically made and readily adapted to any form of roadbed.

RAILWAY —Henry Day, Fairview, N. J. This invention contemplates a new system of constructing and operating railways. A flexible endless traveling rail is to be moved in continuous manner and the cars supported upon this rail by their driving wheels, an independent motor upon the cars also revolving the driving wheels to give to the cars a speed greater than that of the traveling rail. Novel devices are employed for keeping the driving wheels in place on the single traveling rail, and at the stations are inclined shifting track sections to facilitate side-tracking a car without interfering with the continuous operation of the traveling rail.

Mechanical Appliances.

CRANK ARM.—James Benson, Wanaaring, New South Wales. This crank is made in two sections, one of which is keyed or otherwise fastened to the shaft, while the other section is held in front of and against the face of the first one by a washer and screw, the loose section being adapted to abut at one side against a flange of the other section, so that during half a revolution of the shaft the flange carries the loose section, and during the other half the loose section can readily swing in one direction. The device is more especially designed for use in machines for drilling artesian wells and for other machines in which a drop is required.

WIND ENGINE.—Ira A. Jefferson, Park City, Utah Ter. This is an engine or windmill more especially adapted for use in prairie regions or other places where sudden changes of the air currents occur. The fans or sails of the engine are pivotally supported between hoops, whereby their movement is limited and controlled to bring about a certain speed of revolution irrespective of the strength of the wind, but if the wind be too strong, governor weights act to effect a change in the position of the sails accordingly. If the engine is used for pumping, and sufficient water has been pumped into the tank, the rising of the float also operates to stop the movement.

Agricultural.

PLANTER. — William A. Stewart, Crystal Springs, Miss. An attachment to the drop slide of planters or fertilizer distributers is provided by this invention, whereby the area of openings through which the seed or fertilizer drops may be increased or decreased, according to the character of the seed or the quantity of fertilizer it is desired to use. The construction is very simple and the arrangement of parts is such that the operator may, without leaving his position by the planter, change the feed at will, or cut off entirely the distribution of seed or of fertilizer.

HARROW AND WEEDER.—William A. Small, Esbon, Kansas. This is an implement capable of cultivating two, three, or more rows of listed corn at one operation, and may be constructed in sections, with the end sections capable of a lateral movement to correspond to the swaying movement of the team. Weeding knives, designed to operate in the furrows and upon the ridges, are adapted to be adjusted vertically and laterally, and the sections of the implement are so constructed that they may be independently adjusted for proper work in rows of varying width, the sections having harrow teeth also adjustable vertically and laterally. The knives are designed not to clog, even in the most tenacious soil, owing to their peculiar shape and the manner in which they are set.

Miscellaneous.

COLTER AND WHEEL BEARING. — Herbert R. Howe, Howe, Neb. This colter is circular in form and substantially like the ordinary colter, and has a hub provided on opposite sides with perforations in which oil is supplied to lubricate the bearing, the perforations being kept closed by spring-pressed caps countersunk in the hub, so that their outer surfaces will be flush with the outer surface of the hub. The colter is suspended from a beam in the usual way, and will turn easily but cannot wabble, while dirt cannot enter between the axle and the hub.

ARTIFICIAL LIMB. — Alexander Gault, Medford, Minn. The artificial limb provided by this invention is designed to be light and strong, and to be made at a low cost. The foot is of felt, and a shaping spring is located between the sole and the body of the foot, the spring comprising a series of leaves separated and enveloped by flexible strips, holding the foot in a natural position while imparting to it a maximum of elasticity. Means are also provided whereby an artificial limb may be quickly and conveniently attached to a stump and be worn with the least amount of friction or inconvenience.

MAKING BISULPHITES. — Frank J. Peck and James A. Outterson, Dexter, N. Y. This invention relates especially to apparatus for treating solutions of lime and magnesia to make bisulphites thereof. A vertical tubular tower has an inlet for the sulphur fumes and an outlet for the treated liquor, two tanks at the top discharging into the upper end of the tower, within which are breaking arms or fingers, while a pipe leads from the lower end of the tower into one of the tanks, and there is a pump for forcing the treated liquor into the tank for a second treatment in the same tower, thus forming a repeating tower system.

STREET SWEEPER. — George Focht, Jr., Hoboken, N. J. This machine is so constructed that, as it is drawn forward in the operation of sweeping, the brushes throw the dirt into a pan from which it is drawn by the suction of a fan or blower and forced into a covered storage receptacle. When the latter has been filled it is designed to be readily dumped at either side of the machine by the manipulation of a worm shaft. Each brush is driven independently, so that one brush may be operated and the other not, and each brush is made up of a series of removable sections, any of which may be readily removed and replaced by others as they become worn, all of the sections being tied together and held firmly upon the shafts when the machine is at work.

ORE WASHER.—Homer S. Davis, Stillwater, Montana. This device has an amalgamating receptacle placed in an inclined position and provided with a series of transverse strips, each having an opening in its bottom and plugs fitting the openings, to form with the strips compartments for retaining mercury, the sluiceway having in its bottom plates with slits for the passage of fine sand and precious metals. The construction is designed to be simple and durable, and is more especially adapted to separate the precious metals from coarse and fine sand, assimilating the metal with mercury to form an amalgam.

HOSE COUPLING.—William D. Patterson, Keokuk, Iowa. This device is formed of an inner and outer portion, the latter being provided with a circumferential groove containing a movable ring, while spring-actuated latches pivoted in the outer portion are adapted to enter an annular groove in the inner portion, the latches being connected by links with the ring of the outer portion, so that by turning the ring the latches may be withdrawn and the inner portion released. By means of this coupling lengths of hose may be instantaneously connected and readily disconnected.

SHEET METAL CAN.—Frank H. Palmer, Brooklyn, N. Y. This can has a slightly conical flanged open end adapted to be engaged by a circular flange of the cover, permitting of readily placing and locking the cover upon the mouth of the can. A packing disk is also held in the under side of the cover and engaged by the upper doubled-up edge of the conical end of the can body, the contact being a considerable distance from the edge of the packing disk, and the doubled-up edge firmly engaging the packing without cutting it, to prevent leakage.

HASP LOCK — Charles B. Lampkin, Bond's, Tenn. This device consists of a gravity catch or button pivoted on a fixed staple or bolt, and adapted to be readily swung into horizontal position, to pass through the slot of the hasp, automatically assuming the vertical position as it is released, thereby fastening the hasp. The button is beveled at the top, to adapt it to be readily passed through the slot of the hasp, and is made heavier or weighted at the bottom.

BREAD PAN. — Gabriel C. Britton, Boonton, N. J. This pan is made up of a series of connected pans, the bottoms and sides of the pans being formed from a single strip, and the ends in a series from single strips. The pan is adapted to hold a series of loaves, each sectional pan being separated from its neighbor in the same series by an intervening air space, each individual pan being thus isolated, so that the crust may strike it upon all sides, thereby giving a good crust to the loaves.

INDEX FOR BOOKS.—William D. Bevin, Syracuse, N. Y. Ledgers, letter books, and similar volumes, may by this invention be readily provided with an index which will be attached to the book to virtually form a portion of it, while it may be slid out from the book, or slid to place between the leaves of the book and its back without opening the book or interfering with the lay of the leaves when the book is opened.

CONE FOR FORMING HAT BODIES.—Benjamin J. Brown, Jr., Brooklyn, N. Y. Two patents have been granted this inventor for cones having somewhat different perforations, for forming hat bodies from fur, wool, or a mixture of both. The perforations are arranged in such manner that when suction is applied, the fur flying around the cone will adhere in greater thickness to the portion of which the brim is to be formed, tapering then for a short space, which constitutes an intermediate belt, to the crown portion, which is the thinnest. The invention dispenses with a brim board of any description to regulate the suction, and each body formed will be of the same thickness in its several parts.

LAMP BURNER. — Henry L. Green, Jersey City, N. J. The wick-turning spindle provided by this invention projects from each side of the burner, to facilitate the regulation of the wick. The usual wick-regulating spindle has a spur wheel attached to its inner end, and an auxiliary spindle journaled in the burner has a spur wheel engaging the spur wheel on the regular spindle, so that the two spindles will rotate in opposite directions when either one of them is turned.

IRONING TABLE. — Samuel H. Haines, Springborough, Ohio. This is a light, strong, and inexpensive table, which can be readily folded to occupy but a small space and quickly extended for use, being firmly supported in position for use when so extended. The invention consists in the novel construction and combination of the several parts.

FLOOR SCRUBBER. — Viola A. Miller, Aurora, Mo. This device has a single standard supported upon two wheels, with a brush-carrying shaft journaled in rigid vertical and horizontal attachments of the standard, a water tank with a faucet having a nose curved toward the brush being arranged in the space between the standard and shaft. The gear for rotating the brush is arranged vertically, and occupies but little space, so that it may run close alongside a wall or article of furniture, being moved along the floor by a person in standing position, the brush being revolved on the floor by means of a handle convenient to the operator, while soapy water is discharged on the brush from the faucet.

WAISTBAND.—Timothy D. Terry, New York City. This invention is especially applicable to the making of boys' pants, embodying an elastic buttoning loop or tab that yields sufficiently to prevent tearing of the band under severe strain. Separate elastic loops normally extend around the button holes to form a strengthening strand for them, and adapted to be passed through the holes for use separately, as may be desired.

POCKET MATCH SAFE. — Charles F. Widmann, Cincinnati, Ohio. Several useful implements are combined in this safe, in a form convenient to be carried in the pocket. The case is made of sheet metal or other suitable material, and has an intermediate partition wall formed as a spring and a button hook, knife blades and scissors being also so pivoted in the casing as to be readily retained in open or closed position, while there is a handy arrangement for cutting off cigar ends.

LIGHTER FOR CIGARS, ETC.—Sidney E. Smith and Thomas Barnshaw, Brooklyn, N. Y. This invention provides a lighting device to form a part of each individual article, dispensing with the use of matches. A fusee plug is held in the butt end of the cigar, and an igniting tip in contact with the plug, a string extending from the tip centrally through the cigar, which is lighted by pulling on the string. Another form of the improvement is provided in which the string does not extend through the cigar, but outward from the fusee plug in its butt end.

BADGE.—Louis O. Keil, Birmingham, Ala. This is designed as a badge for the Columbian World's Fair, to be made of metal, celluloid, embossed paper, or other suitable material, and is composed of a spread eagle surmounting intertwisted bars, with a pendent ribbon supporting two disks representing the eastern and western hemispheres, the eagle carrying in his bill a suitably inscribed scroll, and there being torches, stars, etc., arranged in the device.

INSECT TRAP. — Frederick Swenson, Belvidere, Ill. This is a small, inexpensive device for placing in a bed to catch vermin, permitting of the ready destruction of the vermin and their eggs.

TOY FISHING APPARATUS. — Izak Samuels, New York City. A box representing a pond contains imitation water inhabitants, fishes, crabs, etc., embedded in or forming a part of each of which is a piece of soft iron, while the fishing tackle supports on its line a magnet instead of a hook, the magnet attracting the iron so that the fishes, etc., may be readily drawn out. The construction is simple and inexpensive, and designed to afford great amusement, the arrangement being such that the one fishing does not see the inside of the tank to make quick and certain catches. The different pieces in the tank may have different values, and then the apparatus may be used to play a chance game.

MARBLE SHOOTER.—Charles E. Wilkinson and Gustav O. Wendel, Broken Bow, Neb. This invention consists of a box provided with a marble-propelling spring furnished with a spring clasp for holding a marble, there being a strap and cup to receive the end of the thumb, while the lower end of the spring forms a finger piece or trigger to operate the shooter.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE PRACTICAL CATECHISM. A collection of questions on technical subjects by manufacturers and others, and of answers thereto. By Robert Grimshaw, M.E., Ph.D. New York: John Wiley & Son. 1891. Pp. v, 296. Price $1.25.

This little work purports to be a collection of questions which have been put to various scientific journals by correspondents, and which have been asked and answered under oath in lawsuits. The scope of the work is very extensive, all sorts of queries being contained and classified in order. We have no doubt the book will be acceptable to many readers. If it were more extensive, its utility would be far greater. The editor in his preface states that the material of the book represents a selection out of his note books, of such queries as seemed best adapted to interest practical men. Most of the examples he states are drawn from actual practice.

THE CHEMIST'S AND DRUGGIST'S DIARY. 42 Cannon Street, E. C., London.

This annual of 446 pages for 1892 contains, in addition to its blank pages for every day in the year, receipts copious in number useful to every druggist, and it also contains several pages of engravings illustrating useful and amusing experiments in chemistry. The latter are placed together under the head of scientific mysteries, rendering them easy to refer to, without the necessity of traveling through a great many pages of advertisements, which the volume contains.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(3747) W. H. S. asks for a fixative for drawings. A. Prepare water starch, in the manner of the laundress, of such a strength as to form a jelly when cold and then apply with a broad camel hair brush, as in varnishing. The same may be done with thin cold isinglass water or size, skim milk, or rice water.

(3748) A. F. H. asks if there is any way by which old photographs which have badly faded can be restored. A. Put the card in warm water until the paper print may be removed from the card backing without injury. The prints can be restored by means of the following solutions: *a*. Sodium tungstate, 100 parts, water 5,000 parts. *b*. Precipitated chalk, 4 parts, bleaching powder (chloride of lime), 1 part, sodium arrochloride, 4 parts, distilled water, 400 parts. Solution *b* is made in a well corked yellow glass bottle, is allowed to stand twenty-four hours, and is then filtered into another yellow bottle. The faded prints are well washed, and placed in a mixture 1 to 2 parts of *b* and 40 parts of *a*. When the intensification is sufficient, the prints are immersed in a solution of 1 part of hypo in 10 parts of solution *a* until all yellowness has disappeared, and are then well washed.

(3749) J. A. W. asks: What is the generally accepted scientific theory for the twinkling of the stars? If it is caused by the earth's atmosphere, how? Why don't all the stars twinkle alike, and why don't the planets and the sun and the moon twinkle? A. The stars being minute points of light are disturbed from their direct line of light by inequalities in the density of the air from varying temperatures and moisture of its different strata—the scintillation being strongest with a dry cold surface wind, and generally stronger toward the horizon, from the greater distance that the light passes through the atmosphere. The planets twinkle less than the stars because they have disks of sensible diameter, which in a measure counteracts the apparent twinkling. The telescope shows the twinkling or scintillation of stars, planets, sun and moon by their unsteady motion or dancing in the field when viewed with moderately high powers. 2. How can iron rust be removed, if at all, from lace curtains? A. A weak solution of oxalic acid applied to rust spots for a few minutes and washed will remove rust stains.

(3750) J. B. asks: What will deodorize fusel oil, as I want to use it in place of alcohol, or can it be deodorized? If so, how? Or is there a cheap volatile oil I could use? A. Fusel oil cannot practically be deodorized. You can use methyl alcohol, so-called wood naphtha or wood alcohol, as a solvent.

(3751) F. V. B. writes: I send you under separate cover a sample of polishing paste for cleaning metals. It is an excellent article for this work, as it cleans with so little work and gives a good luster, works probably the nicest on brass. It seems to dissolve the dirt or oxide on metal easily, but I cannot find that it contains acid or alkali; seems to have no particular taste. Will you please give me your idea as to what it is probably composed of? A. The polishing paste is undoubtedly in general similar to putz pomade with putty powder or some light-colored polishing agent used instead of oxide of iron. For putz pomade the formula often given in Notes and Queries is:

Oxalic acid	1 part.
Iron peroxide	15 "
Rotten stone	30 "
Palm oil	60 "
Vaseline	4 "

It is generally perfumed with nitro-benzole. This of course will be red in color. It is poisonous.

(3752) R. A. McV. asks for a receipt for making solders that do not require acid, but will stick by the article being heated with a candle or other device and the solder rubbed on it. A. Make the solder of 4 parts tin, 2 parts lead, 4 parts bismuth. Melt and mix, then pour in small grooves in a piece of board.

(3753) O. H. asks: 1. What can be used to remove nicotine stains from the ivory keys of a piano? I have been in the habit of laying my cigar down while playing, and notice the keys badly stained. A. Try a solution of oxalic acid on the keys. 2. Is there any explanation to be given as to what causes animals' eyes to shine or glow, and what difference of structure is there in the human eye that this property does not exist therein? A. The glare of animals' eyes is supposed to be caused by the reflection of light from the retina through the large iris usual in animals. 3. What is the best thing to clean window glass with, and also what is best to use to make the polished wood of a piano look bright? A. Use whiting and water for cleaning windows if water fails. Use French polish for brightening varnished surfaces.

(3754) C. A. C. says: Please advise me, through your Notes and Queries, as to what course I may pursue to prevent the acid in tan bark from affecting steel. We are manufacturers of steel wheel barrows, and find that those used by tanners and others, using the barrows for wheeling tan bark, do not last long, in consequence of being eaten by the acid. The steel is the best quality and somewhat soft. A. We know of no better way to prevent the action of the tannic acid than by frequent painting with cold tar. Barrows to be first dipped in hot tar.

(3755) G. S. asks: Which will bend the quickest with the same weight—a piece of gas pipe or a piece of round iron of the same size? Do you know of any test being made regarding same? If so, what was the result? A. Gas pipe is equal to half the bending stress of solid round bars, same diameter outside. See Haswell's "Pocketbook for Engineers," $4 mailed.

(3756) F. H. E. asks: 1. How many revolutions does the motor described in SUPPLEMENT, No. 641, make? A. 2500 to 3000. 2. Will the same motor have power enough to run the dynamo in SUPPLEMENT, No. 600? A. No. It requires 1 horse power to drive the dynamo. The motor is ⅙ horse power.

(3757) J. W. B. writes: Will you give the solution of the one hundred puzzle, taking the numerals 1 2 3 4 5 6 7 8 9 0, and placing them so that when they are added the sum will be 100? A. Accepting algebraic addition, it can be done thus by giving negative signs to some of the numbers: 64+30+9+8+2−7−5−1.

(3758) F. H. V. asks: 1. Explain the action of the toning bath. A. Metallic gold is deposited in place of the reduced silver compounds. 2. Why does silver albumen paper discolor? A. On account of slight decomposition of the silver salts in presence of organic matter. 3. Is there any way, other than by fusing, by which a silver bath can be freed from albumen? A. Try boiling and sunning.

(3759) A. H. B. asks how to stain a violin, and what varnish to use. A. For staining your violin use a solution of ½ ounce dragon's blood to 3 ounces proof alcohol. For a varnish dissolve equal parts shellac and mastic varnish in proof alcohol. Settle and decant the clear varnish. There are a number of receipts for violin varnishes.

(3760) Axiom: See SCIENTIFIC AMERICAN SUPPLEMENT, No. 584, for blue and black print processes.

(3761) G. M. T. asks: Can you inform me through your Notes and Queries what is need to restore the spent manganese dioxide used in the interior of the porous cup of the Leclanche battery? A. The Leclanche battery can be treated as if it was a storage battery, and can be to a certain extent rejuvenated by passing through it a reverse current. Also by pouring some permanganate of potash solution into the porous cup, after draining it thoroughly, its life may be prolonged. New depolarizer is the best remedy. Dolbear's "Art of Projection" is out of print. We recommend and can supply by mail Wright's "Optical Projection," $2.25.

(3762) F. W. H. writes: Please give a receipt for sticking labels to tin boxes. A. Add 4 ounces dammar varnish to 1 pound of tragacanth mucilage.

(3763) Q. C. B. asks: Suppose a vessel to contain one quart of air at normal pressure, say 15 pounds per square inch; if now air be forced into the vessel to 30 pounds per square inch, would the vessel contain 2 quarts of air instead of 1 as before? Again, suppose the vessel to contain 60 pounds per square inch. Would the vessel contain 4 quarts of air if expanded to normal atmospheric pressure again? A. Doubling the pressure doubles the quantity of air which a vessel will hold. The atmospheric pressure is a little less than 15 pounds (14·7 pounds), so that at 30 pounds the air contents of the vessel would be a little more than doubled. At 60 pounds it would be a little more than quadrupled.

(3764) W. S. M. asks: How can I make a small camera suitable for photographing in miniature (say 5×8) sheet music? A. See small camera shown in SCIENTIFIC AMERICAN, October 13, 1888, page 231.

(3765) A. H. M. wants a good formula for making a toning bath for artists' paper. A. Combined toning and fixing bath is made as follows:

Chloride of gold	1 gr.
Phosphate of soda	15 "
Sulphocyanide of ammonium	25 "
Hyposulphite of soda	240 "
Water	2 oz.

(3766) L. J. K. asks: Will you please tell me a composition for the development of dry plates in photography.

A. Eikonogen	1 oz.
Sodium sulphite	1 "
Water (warmed)	40 "

To accelerate development add a few drops at a time of

Water	3 oz.
Carbonate of potash	1 "

Use enough eikonogen solution to cover the plates; it will develop several.

(3767) J. S. J. wants a formula for preparing bromide paper and how to use same. A. It is now made on a large scale by machinery. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 541 and 339.

(3768) P. F. S. says: Kindly inform us what dimensions you would recommend for a round chimney to get the best efficiency from a 2,500 horse power steam plant, tubular boilers. The location of the proposed chimney is fairly good, while not situated upon a hill, it is not in a valley, nor is it surrounded by buildings. A. The size and height of a chimney for so large a power should be computed from an assumed consumption of coal per horse power, which will depend very much upon the kind of engines and capacities of boilers for economy of steam production. If an assumed consumption of 2 pounds coal per horse power is used, your chimney should be not less than 8 feet diameter (round) and 150 high.

(3769) J. B. W. writes: I inclose you a box of trick matches. I want to know what is on them that makes them explode. You light them as if they were an ordinary parlor match, with something rubbed on the side, and when they get burned to that spot they explode. A. The explosive matter on the side of the match is fulminate of silver. A small quantity is gummed to the stick near the igniting end and when the flame reaches the fulminate it explodes. These trick matches are dangerous and so is their preparation, as it involves handling one of the most violent and easily ignited explosives known. Fulminate of silver expodes under a blow or slight concussion. The manufacture and use of these trick matches should be discouraged.

(3770) C. F. L. asks: Can you inform me how to get rid of house sand fleas? The house is new, was occupied about six months and has now stood vacant four or five months. I am told they are in the plaster. A. Carbolic acid one part, water 20 parts, sprinkle the premises thoroughly with this.

(3771) J. E. P. writes: We wish you would kindly advise us how to eradicate Canada thistles. We have a farm, on which they are a great nuisance. A. Prof. C. V. Riley, Entomologist of the Department of Agriculture, to whom we submitted the above, replies as follows: Canada thistles differ from all other thistles in this country, in the possession of root stocks. These run horizontal in the soil at depths varying from a few inches to from one to two feet, and unlike true roots, are furnished with buds from which new stems may arise. They are thus enabled to multiply independently of seed, and are thus very difficult to exterminate. Experiments carried on under the direction of the Illinois experiment station have shown, however, that they may be exterminated by clean cultivation and rotation of crops; as follows: 1. Cut the thistles when in full bloom, as close to the ground as possible. 2. Plow about three inches deep, and sow millet or Hungarian grass, seeding heavily, harrow. This may be done at once or some two weeks after the thistles are cut. 3. In September, plow under the crop; or save it for hay as desired. At all events, plow, and seed liberally with rye. 4. Plow under the rye in May and seed again with millet or Hungarian grass, or plant to some hoed crop and give the most thorough cultivation with continued searching for, and destruction of every remaining thistle. 5. Continue the clean cultivation and sharp lookout for thistles another year.

(3772) E. N. M. asks: Can you tell me what will remove the stain of nitrate of silver from linen goods? It was a solution. A. Rub on the stain a saturated solution of bichloride of mercury.

(3773) B. M. D. says: Is there any way to test the value of fire extinguisher? *E. g.*, I had two formulas sent me for examination. The manufacturers claimed that they had efficiency 37 times that of water. A. The only real test is with a small bonfire, in which similar fires can be put out alternately with water and the composition, otherwise the value of the non-combustible gases and combination can be compared with water alone by computing their values.

(3774) F. W. G., Jr., asks: 1. Would the power of the motor described in SUPPLEMENT, No. 641, be sufficient to drive a fifteen foot boat? A. Yes. 2. What rate of speed can be obtained, from twenty volts, with the above motor, and what sized propeller can be used with the best satisfaction as to speed? A. Probably 4 or 5 miles an hour with sufficient current. Use an 8 inch 2 or 3 bladed propeller. 3. Can a motor be made to reverse, if supplied with two armatures? Are there any such motors, and by whom are they made? A. The motor can be reversed by reversing the current in either the aramature or field magnet, but not in both. For addresses of makers of motors, we refer you to our advertising columns. 4. What form of storage batteries can be used, most advantageously, in the boat referred to in question No. 1, and where can directions be obtained for making same? A. For description of a practical storage battery consult SCIENTIFIC AMERICAN, vol. 61, p. 22, or Experimental Science.

(3775) C. N. B. asks: 1. What is the matter with an ordinary bichromate of potash plunge battery that will run a small motor all right for about half a minute and then slow down and stop? When I raised the zincs and gave it a rest, it would do the same thing again. A. The cause of the failing of the battery may be a weak solution, poorly amalgamated zincs, or an insufficient carbon surface. The trouble is polarization, to avoid which you must first of all have a strong solution and large carbon surfaces. 2. Please tell why photographic plates after being washed carefully after fixing bath, dried, and put away in a dry place, should become covered with white crystals which look like the hyposulphite soda of the fixing bath. How could this be stopped? Would varnishing help it? A. We should say you did not wash the plates long enough, or else fixed them in a mixed bath of hypo. and alum. If you used the latter, there is no easy way to eliminate the crystals.

(3776) D. R. asks: What weight will be necessary to compress a rolled steel ring, inside diameter 36 inches, outside diameter 40 inches, thickness, therefore, 2 inches, and breadth 4½ inches, through a distance of 1¼ inches? Also what weight will be necessary to compress a rolled steel ring, inside diameter 15 inches, outside diameter 17 inches, 4½ inches broad, through a distance of 1¼ inches? A. 8,500 tons for the large ring, 1,900 tons for the small ring, with pressure increasing as the rings spread.

(3777) H. K. F. asks: How can I make a bromide emulsion for coating paper same as the bromide paper sold for enlarging, etc.? A. It will take too much space to describe the process here in full. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 541 and 339, also Wilson's "Quarter of Century of Photography," $4.00, and Abney's "Treatise on Photography," $1.25. Generally the paper now sold is coated by special machinery.

(3778) C. H. says: I have read some valuable advice in your paper. I wish to ask some. I am 20 years old, with common education, $3,000 capital. I can stand hard work. I have no choice for business. Please advise me and I will remember. A. We advise you not to make a business venture without business experience. Choose some business that you would like, seek employment at any price. Save your wages and hold fast to your capital until you can start out for yourself well posted in business details.

(3779) K. F. R. writes: Supposing a man has no special talent or tastes, what branch of engineering is most favorable to health? And particularly as regards civil engineering. In which department of this branch would a man lead the healthiest life? A. As rodman or axman.

(3780) T. H. L. asks: What would be the best way to blacken canvas (8 oz.) so as to have it pliable? I want to make a tent to fish through the ice with. A. For a very flexible canvas a coat of thin rubber varnish mixed with lampblack can be used as a paint. Thin the rubber cement, to be obtained through the rubber trade, with naphtha and add enough lampblack to make a paint that can be brushed upon the canvas.

(3781) W. H. B wrties: 1. I am building the dynamo described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, and would like to know if I can use No. 18 wire on both the field and armature without materially affecting the efficiency of the dynamo? A. You can use No. 18 wire on the field magnet and armature of the motor, and you can connect up your battery to correspond with the winding. 2. Can I use the motor described in SUPPLEMENT, No. 641, as a dynamo, and what changes should I make. Both armature and field magnets are wound with No. 18 wire, and the commutator is made like the one on the dynamo described in SUPPLEMENT, No. 600. A. By using a cast iron field magnet, and winding the armature and field magnet with finer wire, you can convert the motor into a dynamo. A commutator like that described in SUPPLEMENT, No. 600, would answer perfectly. 3. I have a water motor which is 8 inches in diameter; there are 8 paddles; the stream of water is nearly ½ in. diameter, and the pipe leading to the motor ¾ inch. We have about 45 or 50 pounds pressure in our water works; will the motor run the dynamo described in SUPPLEMENT, No. 161, and about what power will it (the motor) develop? A. Without knowing more of the details of construction of your motor we cannot estimate its power, but we think it would be ample for running the dynamo referred to. 4. How much power will the dynamo require to run it? A. About one-eighth of a horse power.

(3782) D. A. W. & Son ask: 1. In a plunge battery as described in SUPPLEMENT, No. 792, how often does the battery have to be recharged? A. It depends upon how much the battery is used. If it is used continuously, the solution will last but four or five hours; but if not used, the solution does not deteriorate except by evaporation. 2. What is about the cost of charging battery once? A. It costs about $1.50 to charge a battery of 8 cells once. 3. How much should bichromate of soda and commercial sulphuric acid cost per pound? Where can it be bought? A. Bichromate of soda costs 14 cents a pound; sulphuric acid (commercial) costs 4 cents a pound in small quantities, and in carboys, 2 to 3 cents. You can purchase these materials of any of the large dealers in this city.

(3783) G. H. writes: 1. I have a home battery made as you described recently. It has one copper and one zinc plate 3 inches square. About how much current will it generate and how long will it last, working constantly? A. The current generated by a battery

of this form is slight. The battery, if sealed so as to prevent evaporation, will work for one or two years. 2. In rewinding the motor described in SUPPLEMENT, No. 641, what size wire should I use on the armature, and also on the magnets, in using it on the Edison circuit? A. Wind the field magnet of the motor with No. 30 wire, and the armature with No. 24, so as to give the machine a total resistance of about 60 ohms. 3. How can I convert metallic silver into chloride of silver? A. Dissolve your silver in nitric acid and precipitate with hydrochloric acid. 4. If I suspend a zinc plate in a solution of zinc, and a copper plate in a solution of copper, and connect a wire to each, will it generate as much current as the Trouve battery mentioned above, and will it last longer? A. If you mean to suspend your plates in separate vessels, no current will be generated; if you mean to suspend your plates in a vessel in which the solutions are separated by gravity, as in the gravity battery, you will find the current much greater than that of the Trouve battery, owing to the decreased resistance.

(3784) J. W. asks: Which of the two, a 36 inch propeller with a pitch of 7 feet, or the same propeller with a pitch of 3½ feet and twice the speed, would be most effective? A. The effectiveness of the propeller will depend upon the shape of the vessel. The long pitch is most effective with boats having fine lines and built for speed. The short pitch is most effective for freight boats, barges and tugs. Of the long and short pitch, as applied to the same vessel, the long pitch will have most slip and the short pitch will require the most power to run it at double speed, so that there is a proper proportion of pitch of wheel for every different proportion in the lines of a vessel, as well as for its line of duty.

(3785) W. H A. asks the process of fiberizing asbestos. A. Asbestos is fiberized by crushing between corrugated rollers.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the number therein given:

(3625) Referring to query and answer 3625, I offer the following as being more simple than the rule already given: When the square of half the chord is divided by the rise of the arc, and the rise then added to the quotient, we have the diameter of the circle, one-half of which is the radius.—JAMES NAPIER.

In answer to inquiry No. 3463, I would say that a coating of paraffine wax in the package will prevent the discoloration of spirits. I believe the tannin in the wood is the cause of the spirits discoloring and a coating that will keep the spirits from coming in contact with the wood will give the desired result.—E. B. S.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 8, 1891,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

DESIGNS.

TRADE MARKS.